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INTERNATIONAL PROJECTIONIST



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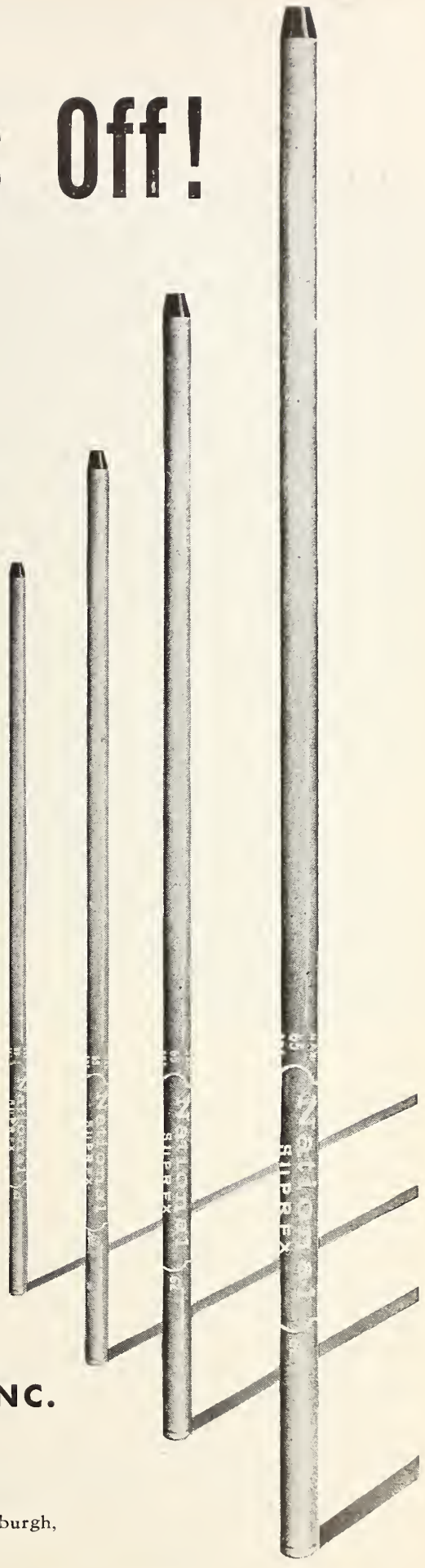
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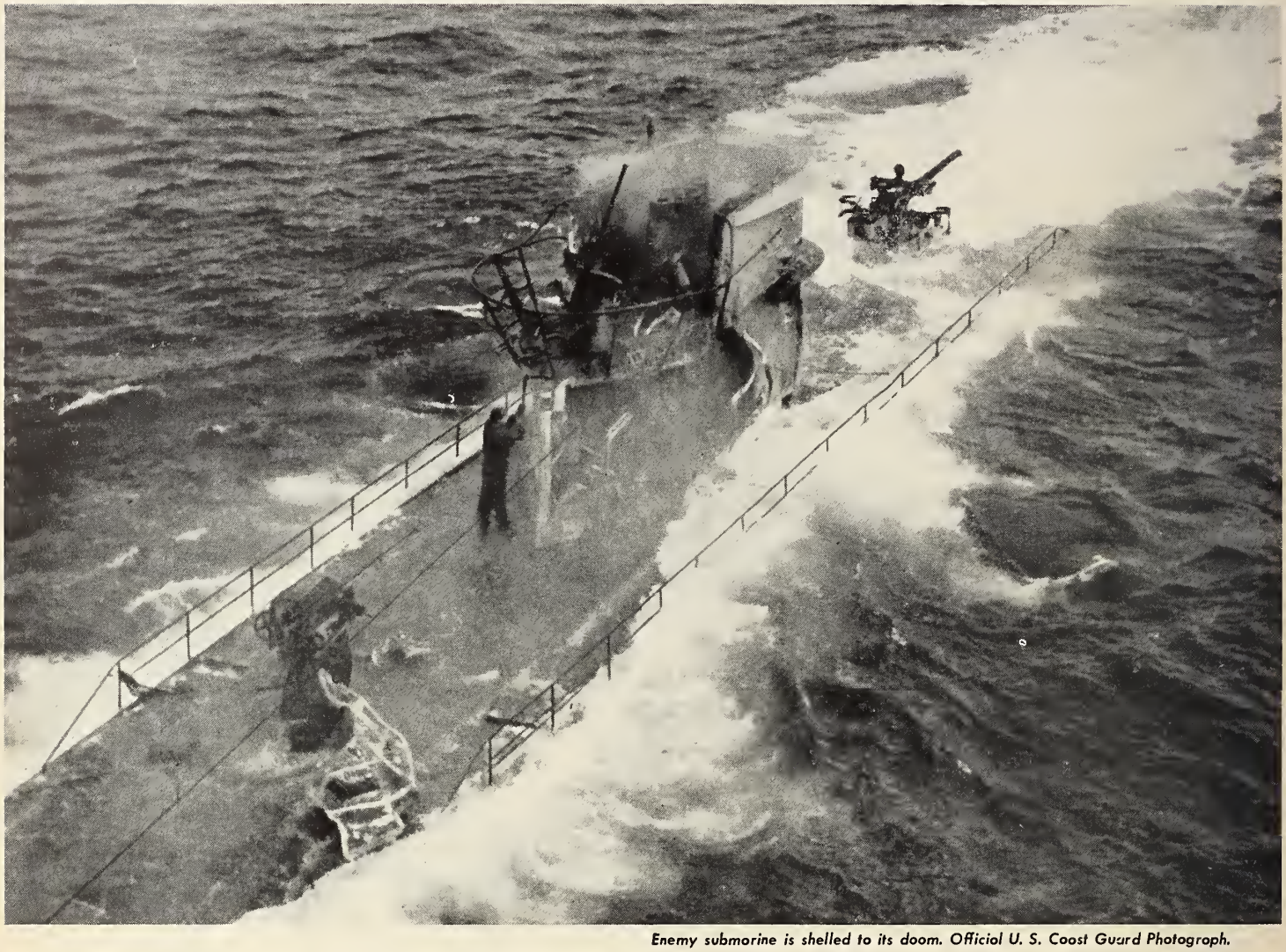
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INTERNATIONAL PROJECTIONIST

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W. L. Lightfoot, *Associate Editor*

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Monthly Chat

EVERY WAR is followed by tremendous changes in the way of the world, according to students of the subject, and they are as sure of changes in the coming post-war period as they are of the actual changes of the past. Wars seem to have a way, it is pointed out, of speeding changes that otherwise would take many more years to develop widely.

Which brings to mind that while the 16-mm film field is not a new one, it is going to broaden out considerably in the every-day life of America after the present World War is over, and it behooves every projectionist in the country to keep abreast of what is going on.

Highlighting the importance of the coming changes is the fact that many I. A. locals are conducting classes on the operation and maintenance of 16-mm projectors. This alone is indicative that something big is on the way, and that in the future this additional knowledge will be highly valuable to those individuals who can see sufficiently far ahead to assure that their bread will be well buttered.

This magazine has carried many articles on 16-mm film projection. Among them are: "Practical Pointers on 16-mm Sound Projection," which appeared in the April, 1943, issue, and "Expanding Field of Non-Theatrical Projection Needs Trained Union Men," in the July, 1942, issue, in addition to many others too numerous to mention herein.

The latter title in particular is indicative of the need for trained projectionists during the post-war period, so that the field will not get into non-union hands. Time has a way of passing fast and "right now" is none too soon to prepare for the new era that is on the way in the 16-mm field.

Then, too, television is going to mean new opportunities for projectionists, especially those who have prepared to meet the new art when it is ready for widespread expansion. Tremendous progress has been made during the war years, and it will not be too long after the close of hostilities that the trained man will find almost illimitable opportunities beckoning him.

• • •

The annual March of Dimes appeal this year is scheduled for Jan. 14 to 31 inclusive, and the motion picture theatres of America have been asked by President Roosevelt to perform the highly valuable public service they have performed during several past years by aiding in the country-wide collections. Every employee can and must do his part, willingly and cheerfully. Last year movie theatres collected $4,667,000, an almost unbelievable amount, to fight the dread infantile paralysis, but this year the need is even greater and that figure must be beaten. That seems to be enough said for this charity. But be sure your theatre sends in its pledge.

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INTERNATIONAL PROJECTIONIST

VOLUME XX JANUARY 1945 NUMBER 9

Photometry As Applied To The Screen †

By *R. HOWARD CRICKS, F.R.P.S.*

WHENEVER the subject of screen brightness is under discussion it must necessarily be pointed out that it is the amount of light reflected from the screen back to the audience that matters, and not the light falling upon it. All projectionists realize, too, that the nature of the screen surface has an important bearing upon the brightness of the picture as seen from different parts of the auditorium. Our object naturally is to secure as far as possible an equal brightness from all parts of the seating area.

But many projectionists who appreciate these fundamental points would nevertheless find it difficult to express the factors concerned in precise technical language. Such factors are embodied in the science of photometry, which simply means the science of the measurement of light.

Light Measurement Snags

Photometry is a particularly awkward subject to study, simply because its units are not simple things like inches and feet, or volts and amperes, but bring in that very ticklish subject of solid geometry. Let us try to summarize this science so far as it applies to the measurement of screen brightness.

First, our fundamental unit of light measurement is the *candle-power*. In theory, this is the amount of light emitted *in all directions* by a candle of closely defined construction, burned under specified conditions. In practice, it is more often produced by means of one of several types of standard electric lamps.

Now, a light source such as our candle may be giving out light in every direction, but most of that light is of no interest to us, simply because we cannot make use of it. Therefore, our practical unit of light flux—the means of measuring the light that we can use—is, to quote the text-book phrase, "The light emitted by a standard candle through unit solid angle." To those of us who have forgotten or have never learned, Book 6 of Euclid, this does not convey very much.

Suppose we had a hollow metal ball 2 feet in diameter. Cut out on the surface a hole 1 foot square (measured across the curvature of the sphere)—that is, a square whose side is equal to the radius of the sphere. See Figure 1. Now imagine that our standard candle is placed at the center of the ball, the inside of which is to be painted dead black. Most of the light from the candle would be absorbed by the black paint, but a certain amount—roughly one-twelfth—would pass through the square hole, and could be made use of.

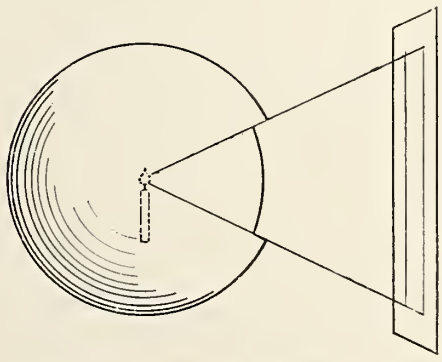


FIGURE 1. *Basis of photometer tests.*

The quantity of light passing through the hole would be one *lumen*. This shows us that there are roughly 12 lumens to a candle-power. A lumen is, note carefully, a *quantity* of light, just like a pint of water or a unit of electricity.

What is Brightness?

Now, brightness is something quite different from quantity; we might liken the difference to that between watts and units. Brightness means *how much light is concentrated into a given area.* In the case of our square hole, we have one lumen of light concentrated into an area of 1 square foot. That is termed a brightness of 1 *foot-candle*. So that a foot-candle is not a quantity of light but it is merely a unit of brightness, equal to 1 lumen falling upon an area of 1 square foot. An alternative definition is the brightness produced by the candle-power at a distance of 1 foot.

Suppose that a foot away from our hollow ball—that is, 2 feet away from the

† *Ideal Kinema, Dec.* 14, '44.

candle—we hung a white screen, so that the light from the candle passing through the hole formed a brightly lit patch on the screen. Because the screen is twice as far away from the candle as the edge of the ball is, the patch of light will be twice as wide and twice as high—that is, 2 feet square, or an area of 4 square feet. But there still is only 1 lumen of light falling upon it, therefore the brightness of that patch of light will be, not as we might think ½ foot-candle, but only ¼ foot-candle. Similarly, if a screen were hung 3 feet from the candle the area of the illuminated patch would be 9 square feet, and the brightness would be only one-ninth of a foot-candle.

This is an illustration of what is known as the *inverse-square law*—a law which applies to many other things besides light. That in the case of a point light source, the brightness varies inversely as the square of the distance.

Here then is our unit for measuring the brightness of light reaching the screen from the arc. If we held a photometer in front of the screen with its cell pointing towards the projectors and it read, say, 5, we should be quite correct in saying that the brightness of the light falling upon the screen was 5 foot-candles. This brightness will, while the size of screen remains constant, be unaffected by length of throw, other than by reason of smoke and dust in the atmosphere.

Light on the Screen

However, the brightness will not be constant over the whole area of the screen; it always is greater in the center and falls off towards the edges. There are various ways of securing an average value from our photometer readings. The most common, and a reasonably accurate method, is to take five readings equally spaced across the centerline of the screen and to average them. Our five readings might, for instance, be, from left to right, 4, 5.2, 6.6, 5.2, and 4. This would give an average of 5 foot-candles.

We can work backwards from these figures to compute the total lumens reaching the screen. Supposing the screen measures 20 feet by 15 feet, that is, an area of 300 square feet. The total amount of light reaching it will be 300 x 5 = 1,500 lumens.

Let us again work backwards and assume that we have this same light output of 1,500 lumens from the projector. Assume, too, that our screen size is increased to 24 feet by 18 feet—an area of 432 square feet. Our average brightness will then be 1,500 ÷ 432, or not quite 3½ foot-candles: So that by increasing the width of the screen by only 4 feet we have reduced the average brightness from 5 to 3½ foot-candles. (This latter calculation must not be applied too literally, because in changing the size of our screen we should have to change the focus, and probably therefore the aperture of our lens).

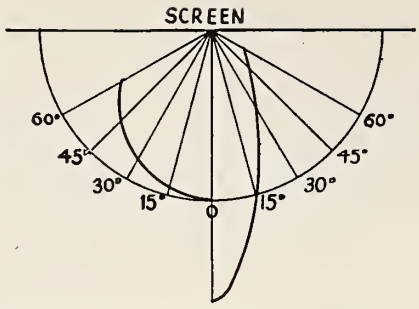


FIGURE 2. ***Polar curves of matte (left) and metallic (right) screens.***

The Foot Lambert

However, as I pointed out in the first paragraph of this article, it is not the brightness of the light falling upon the screen that counts, but the brightness of the light reflected from it. For this sort of brightness we use another—the *foot-lambert*. If our 5 foot-candles of brightness were to fall upon a screen which was a perfectly diffusing reflector, then that screen would have a brightness of 5 foot-lamberts.

Actually there is no such thing as a perfect reflector, and in practice we shall be lucky if we get more than 3 foot-lamberts of reflected light.

One important point of difference between two units: We have seen that the brightness of a light source varies inversely as the square of the distance. But this applies only to a *point* source (which again does not really exist) and emphatically it does not apply to a kinema screen. If we neglect the smoke and dust in the atmosphere, then we can say for all practical purposes that at whatever distance the screen is viewed, it will still have the same brightness.

The value of this reflected brightness will depend chiefly upon the screen surface, and not, as we have seen, to any material extent upon the throw. A brand new screen may, with 5 foot-candles falling upon it, gives us 4 foot-lamberts—which you can work out as an efficiency of 80 per cent—but the chances are that before the screen is scrapped it will be giving only 2 or 3 foot-lamberts. Thus it is not only possible but often actually is the case that mere neglect of a screen will literally waste half the light that the arc is producing.

I say the brightness will be unchanged from whatever distance the screen is viewed; but I do not say from whatever *direction*. If our screen were a perfect diffuser, then it would be, but no screen is and in fact we do not wish that it should be. Every type of screen will reflect more light roughly in the direction of the projector beam than to the edges of the auditorium. Actually, this is strictly true of only one type of screen, the glass-beaded screen. With other screen surfaces, if the beam is on a downward projection rake, more light will be reflected downwards from the screen towards the stalls than upwards towards the circle. (Compare this with the behavior on a mirror.)

Now these curves show something that it is not otherwise easy to discover—the angle from the screen center over which a satisfactory picture brightness will be obtained. It is apparent from the left-hand curve shown in Figure 2 that a matte screen will reflect light fairly evenly over quite a wide angle; therefore for the ordinary kinema, where the front seats at least subtend a wide angle to the screen, this is the only type of surface that would be suitable. On the other hand, for a long narrow auditorium, a metal surface would give a very much brighter picture simply because more of the light is being reflected into the seating area, where it is wanted, and less to the sides of the hall, where, in this particular case, it is wasted.

These curves illustrate the importance of choosing a screen surface of a suitable type to correspond with the shape of the seating area. Suppose we were able to construct a screen giving a polar curve so exactly suited to the seating area that within the area covered by the seating area the curve was at a maximum, but outside this angle it dropped to practically zero. Suppose, furthermore, we were to do the same thing in a vertical plane—that is, our screen would cover the angle from the front stalls to the back of the balcony, and outside these angles again it dropped nearly to zero.

The Polar Curve

Put very simply, this is what lies behind the suggestions that one hears nowadays that screen surfaces of the future may have an efficiency of 300 or 400 per cent more than a normal screen. This is rather an unmathematical way of expressing it, but it remains a fact that if such a screen surface could be produced, and if its polar curve could be accurately suited to the particular auditorium, then one could get a picture several times brighter than at present with no increase of current in the arc.

Are such screens possible? On paper, yes. Such a screen was, before the war, demonstrated for television purposes, where every fraction of light counted. There are difficulties to be overcome in constructing such a screen for the kinema, but they are, I believe, chiefly

commercial—that the screen would need to be "tailored" to suit every individual auditorium and would be, therefore, necessarily very expensive.

Most people will, I think, agree that a brighter picture than today's average is a vital necessity, particularly for color films. Is this extra brightness to be secured by new illuminants or a new type of screen? Time will tell.

The extent to which a screen is diffusing or directional is not an easy matter to specify in words or figures. It is much easier to show it in a curve, and a curve that illustrates the directional properties of a screen is called a polar curve.

Mark out on your stage a point below the center of the screen and put a nail there. Take a piece of string 8 or 10 feet in length, according to the depth of the stage, loop one end round the nail, and at the other end tie a piece of chalk. You can then mark out a semi-circle, with the nail as the center.

Draw a line from the nail at right angles to the screen. By means of a protractor, set-squares, or geometrical construction, mark out angles of 15 deg., 30 deg., 45 deg., and 60 deg. either side of this center-line. You will then have a construction like that of Figure 2.

Now take a photometer or exposure meter and, standing at each of these points on the circle, point it towards the screen and take a reading. You might, for example, find that at the center point you get a reading of 5 foot-candles; at 15 deg. it might be 4¾; at 30 deg. 4; at 45 deg. 3¼; and at 60 deg. 3. Mark out on the diagram corresponding measurements from the nail and join the points to form a curve. This will then be a polar curve of the reflectivity of the screen, as shown at the left of Figure 2.

If you had a metalized screen and were to do the same thing, you would find the readings very different. They might be more like 8, 5, 2½, 1½ and 1 on the respective angles. A curve of these readings would be quite different, as shown on the right of the sketch.

Simple Tests for Polarity

LITMUS paper moistened in a solution of *salt* water turns red at the positive terminal. This test paper, which is quite inexpensive, can be obtained at any drug store, or from any chemical supply house such as Eimer and Amend, New York; Fisher Scientific Company, Pittsburgh; or Chemical Rubber Company, Cleveland.

The local druggist can also make up the following simple polarity tester: one part (by weight) of phenolphthalein dissolved in alcohol, added to ten parts potassium chloride dissolved in a ten percent solution in distilled water. These two solutions are then mixed, and filter paper (also obtainable from the druggist), or white blotting paper, is soaked in the mixture and dried. When remoistened with water, the paper thus prepared will show a red stain at the *negative* terminal.

If two wires are dipped into a solution of salt water, bubbles will appear around both wires, but the greater number will be at the negative lead. This test is less reliable than the others, since it involves judging the quantity of bubbles.

The druggist can also supply potassium iodide, which dissolves readily in water. Blotting paper or filter paper dipped and dried, as before, will, when remoistened and connected across two terminals show a brown stain at the negative terminal. If the blotting paper had a little starch in it (which is sometimes the case) the stain will be blue instead of brown.

A fifty-cent supply of any of the test papers herein mentioned will last any projection room ten years.

None of these simple polarity tests will work very well on extremely low voltage—clearly visible and unmistakable results may be obtained at as little as one volt, but generally they give really definite indications from about three volts up.

USE CAUTION in testing d.c. power lines, arc generator output, or the high voltage supply circuits of amplifiers. Don't *hold* the test paper across live wires! Turn off the current and make sure it is off. If you are testing an amplifier circuit, short the filter condensers. Lay the strip of paper across the terminals, or hook it to them in some way so it will make contact. Turn on current. Turn off the current again (short the filter condensers once more) before removing the paper strip to look at it. Your fingers will be moist from handling a strip of moistened paper.

These tests are useful not only when a voltmeter or other indicator is not in the projection room (which is the case all too often) but also when the line to be tested is of higher voltage than the voltmeter can take. For example, in checking polarity in the B circuits of amplifiers, the voltages may run far beyond the capacity of the voltmeter available, so that attempts to use the meter to check polarity may ruin the meter.

FILM DEMANDS EXCEED CAPACITY OF PRODUCTION

The War Production Board states that because of increased military demands, total requirements for X-ray, aero and 16-mm motion picture film in 1945 are substantially in excess of the film industry's present production capacity. In order to meet military requirements production of 35-mm motion picture, cut sheet and other types of film for civilians will have to be cut below the current level, WPB indicated.

The war agency also stated that consumption of 35-mm motion picture film for entertainment purposes by the motion picture industry in the first 1945 quarter is expected to be cut by ten per cent as compared with the 1944 level, and that this will permit consumption at an average rate of about 70 per cent of 1941 usage for the industry as a whole. In 1941 the major motion picture producers used almost 415,000,000 linear feet of this type of film per quarter. Throughout 1944 the motion picture industry used 35-mm film at about 75 per cent of the 1941 rate.

It was further said that use of 16-mm motion picture film for home movies has already been cut to a minimum, from the average peacetime rate of 65,000,000 linear feet per quarter to the current rate of 1,000,000 linear feet per quarter.

WPB declared that requirements of the Army and Navy alone for 16-mm motion picture film in the first quarter total 142,000,000 linear feet, 8,500,000 feet in excess of the film industry's present capacity. This type of film is urgently needed to make training and other films for the armed forces. To meet the demands of the Army and Navy for 16-mm motion picture film manufacturers in 1944 raised their production rate to seven times the 1941 rate.

SHEPHERD IS NEW PRESIDENT OF ELECTRIC SPECIALTY CO.

David G. Shepherd has been elected president of the Electric Specialty Co., Stamford, Conn., succeeding John M. Wright, who has held the post since 1913, who is retiring. Mr. Shepherd has been general manager of the company since its organization. W. H. Haines, sales manager since 1924, has been elected vice-president and general sales manager.

RCA TO DISTRIBUTE CENTURY ELECTRIC GENERATORS

The theatre equipment section of the RCA Victor Division, Radio Corporation of America, will distribute the Actodector line of theatre-type motor generator sets produced by the Century Electric Company, St. Louis, according to an announcement by F. L. Slade, manager, special apparatus division of the St. Louis company. RCA heretofore has not carried generators in its line of equipment.

Mr. Slade declared that in entering into the distribution contract "we are making plans to augment our production facilities so that we will be in a position to meet the greater demand for generators that will result from world-wide distribution through RCA, plus the pent-up need for generators that will make itself felt when restrictions on civilian production in this field are lifted."

RCA will distribute the Actodector line of generators domestically through the independent RCA theatre supply dealers located in leading cities throughout the United States, a number of whom have been distributing Actodectors for many years.

Highlights of the Television Conference

By *JAMES FRANK, Jr.*

THE Television Broadcasters Association which was formed about a year ago and covers the wide scope of various phases of the industry including broadcasters, advertising agencies, artists and their agencies, manufacturers of both transmitting and receiving equipment, distributors, etc., held its first national conference on December 11-12 in New York, and was attended by over 1,000 people from all branches of the industry. It was felt that it could justly be said that this conference marked the real "birth of television" in this country. We, of course, are principally interested in television as it may apply, or affect, the motion picture theatre. Obviously, from the broad industry point of view, this is comparatively a small segment, and did not receive too much specialized attention. There were, however, a number of discussions about this general subject which I am sure will be of interest to the readers of this publication.

As you probably know, there has been for a number of months considerable controversy in the industry with regard to the matter of standards, and hearings have recently been held by the Federal Communications Commission in connection with reallocations of radio frequencies for all of the services including radio broadcasting, radio communication, television, and fac-simile.

Higher Frequencies Urged

At these hearings the Radio Technical Planning Board and the Society of Motion Picture Engineers made recommendations to the Federal Communications Commission for the allocation of certain portions of the frequency spectrum for television. The principal point of controversy therein was based on the recommendations of the Columbia Broadcasting System that new war developments made practical the use of a much higher portion of the frequency spectrum for television purposes than has heretofore been contemplated. The principal advantage of using the higher frequencies is the fact that much broader channels could be allotted for individual stations which would improve the quality of the transmitted image. This is particularly desirable in connection with the use of color television, the development of which has been principally carried on by the Columbia Broadcasting System.

Present standards for television channels provide for allocations of channels of six megacycles in width. When color television reaches a suitable stage of perfection it is believed it will require channels that are more nearly 20 megacycles in width. Leading engineers, however, have said that if television is to be transferred from its present portion of the frequency spectrum which is in the range from 50 to 108 megacycles, and 156 to 300 megacycles (18 channels of six megacycles each) to from 400 megacycles up which would permit many more 20 megacycle channels, there would be a considerable delay in the commercial introduction of television. This delay would be required to perfect the newly devised equipment.

Naturally, the manufacturers who already have large investments in television are anxious to get started soon after the end of the war and are, therefore, urging the Federal Communications Commission to continue the present allocation with the thought that when the equipment is perfected for the use of the higher frequencies, the transition can be made gradually.

It is interesting to note that in this connection the Society of Motion Picture Engineers has requested allocations of frequencies above 600 megacycles for the exclusive use of theatre television. The general opinion prevalent at the Television Broadcasters Association Conference was that the Federal Communications Commission probably would continue the present allocations and urge quick perfection of apparatus to be used with the higher frequencies. The final decision, however, has not been rendered.



There are, of course, many other problems which will effect the wide commercial introduction of home television, including making available the use of radio or cable networks to permit large groups of stations all over the country to be tied together in the same way as sound broadcast networks now are joined. A. T. & T. described a five year program on which they have already commenced for providing this service.

There also is the problem of making individual transmitters available throughout the country for television coverage, before making available large quantities of home receivers. Opinions were expressed to the effect that home television sets which probably would have to include AM and FM radio as well as a phonograph and conform to certain furniture standards would be relatively expensive, probably costing not less than $300 to $350 each.

Also, the types of programs and the financing thereof would have to be more completely worked out. Some people express the opinion that these problems as related to television in the theatre are now more nearly perfected and more easily solved, and that it might be possible for television in the theatre to get started on a commercial basis, even before television in the home.

Opinions were expressed by leaders in the industry concerning the effect that home television might have on the theatre attendance, and it seemed to be generally agreed that after the novelty had worn off its effect would not be substantial.

New Developments Discussed

Two new developments which will affect theatre television were discussed. One of these is the newly perfected principle of enlarging television receiver images both for the home and the theatre, which were described by RCA. It is pretty generally agreed that the small 10″ and 12″ images used in home television receivers prior to the war are not satisfactory, and that images from 24″ to 36″ in width would be much more desirable. RCA has developed an optical system which involves the use of a small cathode ray receiver tube about 3″ in diameter with a very bright fluorescent screen, focused on a reflector similar to those used in arc lamphouses but spherical in shape, and which considerably magnifies the image.

However, it is important that some means be found for correcting the distortions imparted to the image as a result of the receiver tube face not being flat, and because of both the spherical shape of the reflector and the aberrations or distortions which the reflector creates. Following the principle of the Schmidt Astronomical lens system, a corrective lens is placed around the neck of the television receiver tube through which the reflected image from the reflector passes. It is thus possible to almost completely eliminate the distortions and project a picture, which, in the case of a home receiver, is reflected on a flat mirror to the front of the console so that it can be easily viewed.

This same principle is employed by RCA in its large screen television receiver for theatres. Heretofore, the use of this type of optical system in the field of astronomy has called for highly expensive complicated reflectors and lenses. Making the optical parts in a similar way for either theatre or home television would be exorbitant. Consequently, RCA has devised means of producing these optical parts by casting them, using plastic materials similar to Lucite or Plexiglas which are quite satisfactory and do not require polishing. In this very ingenious manner they have solved the economic problem. They plan to introduce this product in their post-war television receivers.

The other interesting development which would affect theatre television was described by officials of Paramount. In attempting to solve two important problems, one of which is to produce television images on a very large screen, such as is used at the Paramount Theatre in New York, with satisfactory light intensity and the second is to solve the problem of projecting television images at a time when it will not unduly interfere with the presentation of motion pictures, the Dumont Laboratories (a subsidiary of Paramount) developed a system of making motion pictures in the theatre of television programs received, which can be projected over the regular sound motion picture equipment at the theatre when desired.

In this system television images that are received over the air are photographed on positive film and processed so rapidly that within approximately four minutes after they have been received they can be projected on the screen in an entirely satisfactory manner. This interval is so small that it should not in any way affect the extremely important problem of viewing the image as the action takes place. In so doing the presentation of motion pictures is not affected. In the event that it is not possible to break into the picture show at that particular time, the television film can be held for a matter of minutes or hours and presented at some later time when it is more convenient.

Sports Programs Popular

Another interesting presentation by the General Electric Company, which has been operating a television station in the Schenectady-Troy-Albany area for several years, indicated that the programs which were of greatest interest in the home were those where the outcome was not known in advance. In the order of importance, this consisted of sports programs, quiz programs and other types of programs involving audience participation. Here we find the time and suspense element. In other words, the average person has much more interest in viewing a sporting event before they know the winner, rather than seeing subsequently what is equivalent to a motion picture of the event. This opinion is particularly significant in view of the fact that a number of people believe that the success of theatre television to a large extent depends on the presentation of sports events, particularly during the daytime hours when theatre attendance is not at its best.

This strengthens the belief that enough additional income would be derived from the presentation of sporting events by television in the theatre during the daytime hours to justify not only the installation of television equipment in the theatre and the corresponding networks involved, but also the scheduling of the sporting event in relation to the best television viewing time rather than solely for the benefit of the relatively few people who could actually attend the event. Furthermore, it is quite evident that television broadcasting of sporting events could well provide a better viewing of the event in a remotely distant theatre than would be possible by many of the people actually attending the event.

There was also considerable discussion at the conference about the use of motion picture film for home television entertainment which is, of course, of interest to those of us in the theatre field from several different points of view. We are interested because it may mean more jobs for projectionists, and more motion pic-



CEMENTING AMERICAN-MEXICAN LABOR RELATIONS

American and Mexican delegates to the California District Number Two conference recently held in El Centro, Calif., were feted at a dinner given in their honor at the Gambrinus Inn in Mexacali. In addition to the stage and motion picture delegates from Mexican unions, many Mexican officials and labor dignitaries attended the meeting.

I. A. locals in southern California were represented by C. B. Callahan, Local No. 112, San Diego; G. J. Schaffer, Local No. 150, Los Angeles; C. W. (Pat) Offer, W. R. McCormick and C. R. Silver, Local No. 165, Hollywood; W. W. Wise, C. D. Collins and R. Wise, Local No. 297, San Diego; W. L. Coleman, A. V. Narath and R. Adams, Local No. 504, Santa Ana; W. R. LaBar, R. J. Taliaferro and A. S. Bennett, Local No. 521, Long Beach; B. H. Davis, R. C. W. Bennett and Duncan, Local No. 577, San Bernardino; R. W. Barrigan, J. Miller, S. Miller and McCullough, Local No. 656, El Centro; Z. Fairbanks and Casey, Local No. 695, Hollywood; T. Ellsworth, W. V. Jeffries and McGrath, Local No. 705, Hollywood; A. L. Jenkins, Local No. 707, Hemet; A. Erickson, Local No. 727, Hollywood; A. T. Dennison, Local No. 728, Hollywood; and M. Barker, Local No. 761, Chula Vista.

ture projection equipment in television studios. It may mean a need for more producers of motion pictures, and it may affect, in one way or another, theatre operation if the same films are to be used for television broadcasting that are to be used for theatre exhibition.

There is wide divergence of opinion as to the percentage of television programs that will depend upon films. Some people believe that the use of films, at least for background projection on sets, will be extremely desirable in the same way that it is in motion picture studios today. Its use in this manner would conserve the cost of sets to a large extent, and materially enhance the presentation. It might also be possible to accomplish the same objective by electronically blending a motion picture with a live pickup.

It was indicated that motion pictures, probably of the 16-mm size, will be used extensively for first photographing the entire presentation, editing it, and then broadcasting it from film. Stock scenes, location shots, etc., could easily be spliced into this type of presentation. It was also felt that at least some portion of the television program would originate from films, perhaps of the industrial type as well as the entertainment type. But whether or not these would have to be produced especially for television remains to be seen. No one seemed to feel that current feature motion pictures would be diverted from theatre exhibition to television broadcasts. There are considerable differences of opinion over relative interest exhibited in the home between feature pictures and a series of short subjects.

From the foregoing it can be ascertained that there still are many problems that need to be solved, some only through actual experience. I think it is safe to say that as a result of this conference and the presentation of the many different phases of the industry, television has really been launched and awaits only the end of the war and the lifting of restrictions to get under way in the theatre and the home.

Presenting: Harry F. Petty



HARRY F. PETTY, president of the Kentucky State Federation of Labor, was born in Louisville at exactly 1:33 A. M. on Oct. 16, 1896, with a lusty yell announcing his advent into this vale of tears. More or less since that time the same voice, with greater resonance, has been raised in the cause of labor, and generally what Harry went after he got.

He won an education the hard way, for he quit grade school at the age of fourteen because he had to get out and help his widowed mother. Soon after his start in the world of labor he became a theatre candy butcher at the old Avenue Theatre, then playing the blood-and-thunder shows. Remember? Such as "Across the Pacific," "Bertha the Sewing Machine Girl," and so on.

From that point Petty started in as operator's helper in the third nickelodeon in Louisville, and it was not long before he helped organize an operators' helpers union. He was elected its *first* and *last* president, due to the fact that the present operators' local, No. 163, frowned on an assistants' union, and so that was that. According to Petty, "you know you can't buck our I. A."

Due to his immature age he worked for years as a helper, but could not join the operators' local as he was not yet 21. Needing some additional money, he quit his job and started in as a sign painter's helper, where the emoluments were somewhat higher. He then joined Painter's Union No. 512, and worked at that trade until 1921, when he returned to the theatre as an operator on permit. He was accepted and obligated as a member of Local No. 163 on Feb. 1, 1922. Since that time he has held only three regular jobs, the last and his present one with Loew's, starting in September, 1928, going into seventeen years.

Upon joining No. 163 Petty took a wide interest in the local's affairs, and was elected vice-president in 1923. He served two years in this post and at the 1925 election became business agent, holding that position for nine years. During this time he served the union as delegate to the Central Labor Union and in 1931 was elected president of the C.L.U. Petty was defeated in Local 163 for business agent in 1932, but he continued his work for the C.L.U. He was elected as the seventh vice-president of the Kentucky State Federation of Labor at the 1937 convention, and moved up the ladder to second vice-president in 1943, 121 to 101. His opponent was one of the finest and one of the best liked men in the State of Kentucky.

Not yet fifty, Petty has a lot of pep and ideas left and we hope the next fifty years or more will be as interesting, happy and productive as those preceding. It will be good for him and good for labor.

DEVELOPMENT OF LIGHT TRACED IN NEW STRONG BOOK

In his new book "Lamplight," Harry H. Strong, of the Strong Electric Corporation, Toledo, Ohio, traces the development of light through the corridors of time. Elaborately produced, the book is being sent to exhibitors by the Strong company, manufacturers of projection arc lamps. The book emphasizes that civilization's progress has been largely dependent upon man's ability to understand light and how to put it to work.

The story, starting with the light of the bonfire, and ending with the modern lamps of today, covers the various stages of development, and touches upon the splinter light, rush light, torch, grease lamp, wick, teapot lamp, candle, street lamp, gravity lamp, chimney, gaslight, arc light, limelight, kerosene lamp, match, reflector, incandescent lamp, mantle, petrol-air, Cooper-Hewitt, shades, lanterns and fluorescent tubes.

Of special interest to exhibitors is the parallel story which tells how manufacturers of theatre equipment seized upon each improvement in lighting to make superior products.

The book, beautifully illustrated by large charcoal drawings, is an outstanding example of the graphic arts. It is the third of a series of annual publications on highly technical subjects told in the language of the layman, and has been accorded high praise by theatre men, colleges, scientists, industrialists, professors and students.

CAMERA FILM PRODUCTION FALLS BELOW NEEDS

Members of the Photographic Film Advisory Committee were told recently by the War Production Board that 1944 production of camera film has fallen below military and civilian requirements. It also was pointed out that estimated requirements for 1945 are in excess of present production capacity. WPB officials asked industry representatives to submit their considered opinions as to ways for increasing output.

WPB also announced that steps have been taken to release more camphor for film-making. It was indicated that some new control may be placed on the distribution of sensitized paper. Committee members recommended MRO (maintenance, repair and operating supplies) rating for purchase of sensitized paper be eliminated, stating that it is not aiding equitable distribution.

FILM OUTPUT SHOWS 10% DROP

There was about a 10 per cent drop in photographic film production during the third 1944 quarter as compared to the second quarter, according to the Consumers Durable Goods Division of the War Production Board. During the third quarter, it is pointed out, certain film producing equipment was temporarily out of use while being cleaned and repaired.

Projectionists' Course on Basic Radio and Television

By *M. BERINSKY, E.E.*
MEMBER OF INSTITUTE OF RADIO ENGINEERS

VII—ELECTROMAGNETISM

IN THE previous instalment we discussed the fundamental properties of magnetism as applied to permanent magnets. In practice it is sometimes desirable to obtain a magnetic field which is much stronger than that which is possible through the use of permanent magnets. Strong magnetic fields are necessary in large lifting magnets, large dynamic speakers, motors, generators, relays, etc. For such uses, electromagnets are almost universally used. Because of the widespread use of these magnets a discussion of electromagnetism will follow.

The relation that exists between electricity and magnetism had long been suspected. In 1819 Hans Christian Oersted, a Danish physicist, showed that this relation not only existed but that it was a very definite one. Oersted brought a small compass near a wire that carried a current. The compass consisted of a small magnetized needle which was pivoted at the center so that it was free to rotate. The hook-up that Oersted used is illustrated in Figure 1. When he brought the compass near the wire carrying a current he found that the needle was deflected. This indicated that a wire carrying a current has a magnetic field around it because a magnetic field is necessary in order to deflect the compass needle.

Oersted observed further that the compass needle always tends to set itself at right angles to the direction of the current. Scientists have proven that a moving electron sets up a magnetic field. A current flowing through a wire consists of many millions of electrons in motion; it is for this reason that a current flowing through a wire sets up a magnetic field which surrounds the wire.

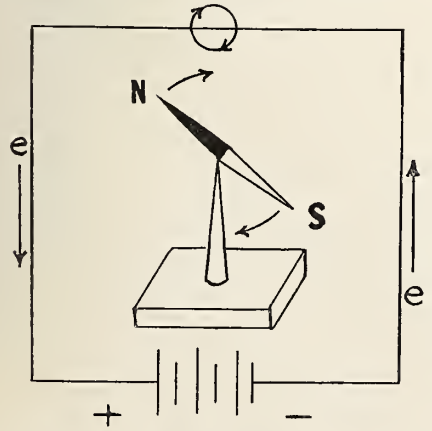


FIGURE 1. *The field around a conductor will deflect a compass needle.*

When a compass needle is held above a conductor carrying a current, it points in a direction opposite to that which it assumes when held beneath the conductor. Careful investigation shows that the magnetic flux exists in concentric circles about the conductor, assuming that there is no other magnetic field in the immediate vicinity.

Field Around Conductors

Figure 2 shows the magnetic field surrounding a conductor carrying a current. The cross indicates that the current is traveling into the paper, away from the observer (the feathered end of an arrow). A circle represents the approaching tip of an arrow and indicates that the current is flowing out of the paper, toward the observer. Notice that the direction of the lines of flux are opposite for the two conditions shown in Figure 2. Note also, the direction of the compass needle when placed above and below the conductor carrying a current. If the current in the conductor be reversed, the direction in which the compass needle is deflected also will reverse, showing that the direction of the current is responsible for the direction of the magnetic field.

The fact that the magnetic lines of force exist in circles perpendicular to the conductor explains the reversal of the direction of the compass needle when moved from a point above the conductor to a point beneath it, since the direction of the field above the conductor must be opposite to that beneath the conductor.

Wires carrying electric currents act like temporary magnets. When current flows through a wire the lines of magnetic flux radiate from the center of the wire in concentric circles. These circles extend along the entire length of the wire. Because the wire has lines of flux around it, a temporary magnet is created. When the current ceases to flow the field collapses toward the center of the wire and disappears, causing the magnetism to disappear also. Owing to the fact that these lines of force exist only when the wire is carrying a current, the magnet thus created is considered to be a temporary one.

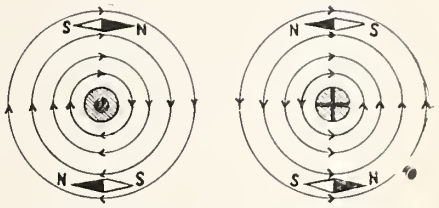


FIGURE 2. *The direction of the lines of force around a conductor depends upon the direction of the current.*

A very definite relation exists between the direction of the current in a conductor and the direction of the magnetic field which surrounds the conductor. This relation can easily be remembered by the following simple rule known as the "left-hand rule." *Grasp the conductor in the left hand with the thumb pointing in the direction of electron flow, and the fingers will point in the direction of the lines of flux.* This rule is illustrated in Figure 3. Notice that the finger tips point in the direction of the flux.

When two parallel conductors carry a current flowing in the same direction, there will be a tendency for the two conductors to be attracted together. The magnetic fields act like elastic bands trying to draw the two conductors together, and the fields aid each other and add up to a maximum value. This may be seen in Figure 4a. Notice how the fields tend to combine. The field due to each conductor is still circular but the resultant field is no longer circular; instead, it takes the shape shown in the illustration. It is as if each adjacent circle of flux

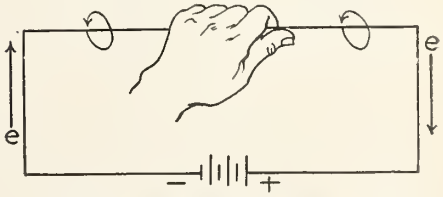


FIGURE 3. *Left-hand rule for a straight wire.*

contained magnetic poles of opposite polarity, causing them to be drawn together.

When two parallel conductors carry currents which flow in opposite directions, there is a tendency for them to be repelled away from each other. Figure 4b illustrates this point. It seems as though each circle of flux in both conductors contained magnetic poles of like polarity, causing them to be repelled. The following rules may now be stated: (1) *Conductors carrying current in the same direction tend to be drawn together;* (2) *conductors carrying current in opposite directions tend to be repelled from one another.*

These facts are the reason why much trouble is experienced in large power stations. In large power stations the conductors carry tremendous amounts of current. Under short circuit conditions these currents rise to enormous values. The strength of the magnetic fields around conductors carrying current is dependent upon the value of the currents. Under short circuit conditions these fields are very strong, and they have been known to wrench heavy bus-bars from their clamps. Transformer coils have been pulled out of place and transformers have been wrecked by the forces produced by these large magnetic fields. This is one reason why heavy duty power transformers have coils that are wound with rectangular wire instead of round wire. Rectangular wire, when wound as a coil, can better resist these forces than coils that are wound with round wire.

Electromagnets

A straight piece of wire does not make a practical electromagnet. In order to create a very strong electromagnet using a single piece of straight wire, a current of several hundred amperes would be required to energize the wire. Such a large value of current is not always available, especially in communications circuits where in some instances relays and other types of electromagnets must operate on less than one-thousandth of an ampere.

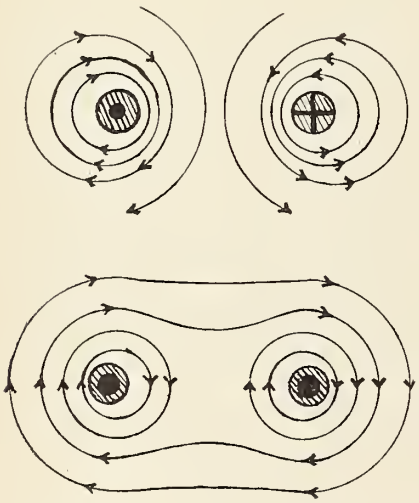


FIGURE 4. ***(a) Top, field around two parallel conductors—current in same direction. (b) Bottom, field around two parallel conductors—current in opposite directions.***

DECEMBER QUESTIONS AND CORRECT ANSWERS

1. A north pole will *attract* a south pole.

2. A south pole will repel a *south* pole.

3. A north pole will induce a *south* pole in the end of a piece of iron nearest to it.

4. Name three uses for permanent magnets in radio or electrical work. *(1) Fields for dynamic speakers, (2) compasses, (3) fields for headphones, etc.*

How can we create a strong electromagnet which will operate on a very small amount of current? When two parallel conductors carry a current in the same direction the strength of the magnetic fields is combined. The solution then is to place several conductors parallel to each other and to have their currents flowing in the same direction. In a straight piece of wire the current flows in the same direction because one end of the wire is connected to the positive terminal of a battery and the other end is connected to the negative terminal.

To place the fields in a straight piece of wire so that they are parallel to each other it is necessary to wind the wire in the form of a helix. Such a winding is known as a coil or solenoid. The magnetic field around a solenoid may be seen in Figure 5. This field is much stronger than the field around a single turn of wire.

The solenoid may be considered as consisting of a large number of turns placed together. The winding may consist of only one layer of wire or it may contain several layers, depending upon the desired strength of the magnet and the length of the coil form. Practically all electromagnets are of the type shown in Figure 5.

Strength of Electromagnets

We have learned that the strength of an electromagnet is dependent upon the amount of current flowing through a wire and the number of turns in a coil. These two quantities were previously considered separately. For example, we learned that the strength of the field surrounding a wire carrying a current was considerably increased when the current increased. Also, that more than just one turn of wire was necessary in order to make an electromagnet that was commercially practicable. These two quantities are treated together when the strength of an electromagnet is to be considered.

The strength of an electromagnet is given by the formula M.M.F. $= 1.26 \times I \times N$, where 1.26 is a constant, I is the current through the coil in amperes, N is the number of turns in the coil, and M.M.F. is the magnetomotive force in gilberts. Since the number 1.26 is a constant, the formula shows that the strength of an electromagnet is dependent on the product of the current and the number of turns in the coil.

A magnet of 1,000 turns of wire and carrying one ampere would have a magnetic strength of 1,000 ampere-turns. A magnet of 100 turns and carrying a current of 10 amperes would also have a magnetic strength of 1,000 ampere-turns, as would a coil of 50 turns carrying a current of 20 amperes. In the above examples each magnet would have the same amount of magnetic strength, since the number of ampere-turns is the same in each case, namely, 1,000. In radio practice, because the current is small, coils usually are wound with many turns.

The Iron Core

So far, we have considered only one type of commercial magnet. This type consists of several turns of wire wound around a coil form. Because nothing was inserted into the coil such a magnet is known as an air-core type. In practice, such a coil is not used very often as it is not electrically economical. While it is possible to obtain very strong magnetic fields with air-core coils, many turns of wire and large amounts of current are required.

Most economical operation of magnets occurs when the minimum number of turns and the least amount of current is used in order to obtain a given magnetic field strength. We remember from the previous article that iron has a permeability many times that of air. This means that iron has the ability to produce a more concentrated magnetic field than is possible with air.

In practice, a core of soft iron or soft

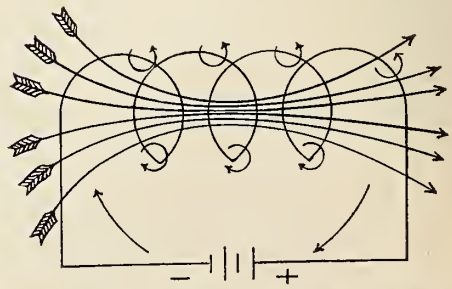


FIGURE 5. ***Magnetic field around a solenoid.***

steel usually is used instead of air. This produces a magnetic field which is several thousand times greater than that which is obtained when air is used. The iron core concentrates the magnetic flux in a small area and helps to reduce leakage flux. The symbol for an iron core magnet or coil is shown in Figure 6. The lines above the coil represent the iron core. The symbol for an air magnet or coil is the same with the exception of the lines.

Polarity of an Electromagnet

It often is desirable to be able to determine the polarity of an electromagnet. We can do this by two methods. The compass needle can be used most conveniently for this purpose. Bring the north pole of a compass needle near the pole of the magnet. If the pole of the magnet is a north pole, the compass needle will be repelled because we learned that like poles will repel each other. If the pole of the magnet is a south pole, the north pole of the compass needle will be attracted because unlike poles attract each other. The left hand rule, mentioned earlier in this article, also is used for the purpose of determining the polarity of electromagnets.

Two variations for the use of the left hand rule are as follows: *To determine the polarity of an electromagnet, grasp the coil with the left hand so that the fingers encircle the coil in the direction in which the electrons are flowing. The thumb will then point to the north pole (the other pole will, of course, be the south pole). If the north pole is known, grasp the coil with the left hand so that the thumb points in the direction of the north pole and the fingers will then encircle the coil in the direction of the lines of force.* Figure 7 illustrates this rule.

Commercial Electromagnets

Commercial electromagnets take many forms, shapes, and sizes. They are used chiefly as controlling devices in electrical and mechanical machinery. In radio communications, electromagnets have been limited to only a few applications, but those few applications have been most important ones.

One of the most important uses of electromagnets has been for lifting various forms of iron and steel. These magnets can pick up bulky pieces of iron and steel which would otherwise require the use of heavy chains and slings. Lifting magnets are used in steel mills for handling

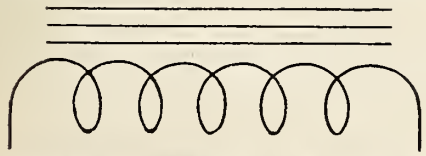


FIGURE 6. *Symbol for iron core coil or magnet.*

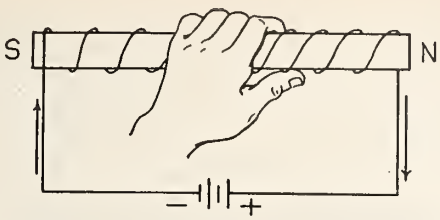


FIGURE 7.—*Left-hand rule for solenoids.*

steel billets which are not red hot. Red hot iron or steel loses its magnetic properties and can not be lifted by magnets. These lifting magnets are specially useful in railroad yards for the lifting of steel rails and steel car wheels; they are also used in the loading and unloading of scrap iron and steel.

Magnetic separators are used to remove steel and iron from coal, sand, rock, ore, etc.

The magnetic brake, manufactured by the General Electric Company, is used to some extent, on electric railway cars, particularly on very severe grades. The brake shoes are made of hard wear-resisting steel. They are suspended on heavy springs so that they clear the rails by about ¼". When the magnetic coil is energized, the brake is magnetically attracted to the rail and the force of attraction between the brake and the rail provides the necessary adhesion for braking. The magnetic brake may be used on slippery rails since its action depends upon magnetism and not on friction.

Another advantage is that it does not produce flat wheels as do mechanical brakes. The braking action of the magnetic brake is controlled by a rheostat which is connected in series with the exciting coil and varies the current through the coil, thereby changing the ampere-turns.

Electromagnets are used to provide the magnetic fields of motors and generators. Relays, both of the plunger and the armature type, depend upon electromagnetism for their action. The telegraph sounder is a relay of the armature type. An electromagnet is used on an electrodynamic loudspeaker to provide a strong magnetic field although permanent magnets are replacing the electromagnet in this application.

The voice coil in a dynamic speaker and the motor coil in an earphone are types of electromagnets. In television, the electromagnet is used to deflect the electron beam in a cathode-ray tube if it is of the magnetically deflected type.

JANUARY QUESTIONS

1. Why does a coil make a stronger magnet than a straight wire?

2. Calculate the number of Gilberts in a coil of 1,000 turns carrying one ampere.

3. Name three uses for electromagnets.

The correct answers to these questions will appear in the next issue.

OPTICAL TRAINING FILMS ARE ACCEPTED BY GOVERNMENT

Six visual aid units on optical craftsmanship, produced for the United States Office of Education by the Bell & Howell Co., were recently formally accepted in Washington. The films were over a year in the making, it is announced. Each unit comprises a sound film (running time from 20 to 30 minutes), a silent filmstrip (40 to 70 frames in length), and a 16-page illustrated instruction manual. The series was produced in collaboration with the U. S. Navy, which has under way a similar group of eight films dealing with the grinding and polishing of flat surfaces.

A formal pre-view was held in the screening room of the Office of War Information, with Navy, State, Agriculture and other government departments represented. British, Russian and Chinese government representatives have expressed interest in getting prints for their own optical industries.

W. E. DECLARES 50c DIVIDEND

Western Electric Company declared a dividend of 50 cents per share on its common stock. The dividend was payable on Dec. 29 to stock of record at the close of business on Dec. 22.

Union Agreements Provide for Arbitration †

ALTHOUGH an employer-union agreement fixes working conditions for a specified period, the parties may be unable to settle specific disputes, and may accept arbitration by an outside party. Three of four union agreements in 14 important industries provide for arbitration as a last resort. Such provisions are more frequent in agreements with large companies than with small plants.

A small proportion provide permanent arbitration machinery—the majority specifying selection of an arbitrator or arbitrators when needed. Generally arbitration may be initiated at the request of either party. In some instances, however, mutual consent is required. The arbitration agency is usually tripartite but permanent arbitration agreements tend to designate a single arbitrator.

Selection of the arbitrator or arbitrators is in most cases by mutual agreement of the parties, often with some neutral agency designated to make the appointment if the parties cannot agree. Over half the agreements establish time limits for decisions. Arbitration is most frequently limited to disputes over interpretation or application of contract terms.

† *Labor Information Bulletin, Nov. 1944. Published by U. S. Dept. of Labor.*

IN THE SPOTLIGHT



By *HARRY SHERMAN*

WE HAVE been swamped with letters from all parts of the country in answer to an item that appeared in these columns last month relative to overtime pay for projectionists working on holidays. We must confess we had no idea that the subject would arouse so much comment in the field, and in a future issue we shall publish a few of the most interesting letters—with the permission of the writers, of course.

We were amazed at the number of I. A. men who write that they have long given serious thought to the matter and wondered why this situation was tolerated and permitted to continue. A few writers derided the thought of projectionists getting extra pay for working on Sundays and holidays, stating that it would revolutionize show business and that the exhibitors would fight tooth and nail to prevent it. With both these statements we agree—however, every advantage gained by organized labor was considered revolutionary when first proposed and bitterly contested by employers.

Today our craft is just beginning to get the recognition from the industry it deserves. Almost every contract signed by local union officials today carries the clause "vacations with pay" for their members—something practically unheard of in the craft twenty years ago. This, too, was considered revolutionary when first introduced and was accepted only because of the persistence and determination of progressive union officials to gain for their members some of the benefits granted to and enjoyed by other unions.

● Through the efforts of C. W. (Pat) Offer, business agent of Hollywood Local No. 165, and E. W. Harper, chairman of the Television Committee, television classes for the members have been formed and are now established at the Hamilton, Hollywood, N. Hollywood and Manual Arts High Schools. Technical training information and electrical parts are being furnished by Mr. White of Electrical Research Products. Over 200 members have enrolled for these classes.

Additional classes are now being established in the Glendale Junior College for the members living in this area. Since the television laboratory at the college may be used in conjunction with the television classes, it should prove an ideal setup.

● Realizing that the 16-mm field holds unlimited possibilities for the craft, Local No. 306 is holding daily demonstrations at union headquarters at which the members are instructed in the operation and care of 16-mm equipment. This is an excellent idea and the officials of the union should be commended for their foresight.

● While reading a Ripley "Believe it or Not" in a local newspaper we learned that Edward Stanko, sound engineer with RCA Service Company in Camden, N. J., completed a four-year high school course in only 16 months. Ed is a quiet unassuming chap and is considered one of the best sound engineers around here. Incidentally, he is a member of New York City Local No. 306.

● Thad Barrows, president of Local No. 182, Boston, Mass., was re-elected to office for the 28th consecutive term, and for the first time in the history of the local he had an opposing candidate. However, our informant advised us that out of a total number of 171 votes cast, Thad received 140. Guess the boys up around Boston know what they want and do not hesitate in making their wishes known.



Thad Barrows

In passing, we might mention that Local 182 has successfully completed negotiations calling for TWO WEEKS VACATION WITH PAY, plus a $3 per week increase retroactive to September first. Contracts have been signed, sealed and delivered. Congratulations for a good job, well done.

● We recently had a most interesting chat with Gregory L. Irsky, Chief of the Motion Picture Equipment Division of the Soviet Government. Irsky formerly was a projectionist in Russia and takes a keen interest in projection matters in this country. He promised to write an article for the readers of I. P. on projection in his country which, we believe, will prove most enlightening.

● A new contract with the downtown theatres calling for a 7½% pay increase for its members, has just been announced by the officials of Local No. 343, Omaha and Council Bluffs, Nebr. Business agent Howard Jackson and secretary Clyde Cooley are to be congratulated for a fine job.

Cooley has had pretty tough sledding for the past year, but the toughest blow was losing his wife. His only son, Raymond D. Cooley, member of Film Exchange Local B-47, recently joined the Navy, leaving Clyde pretty much on his own these days. However, his many union activities, a blessing in disguise, give him very little time to dwell on his personal affairs. In addition to being secretary of Local 343 he is secretary-treasurer of the Nebraska State Ass'n of I. A. Locals, secretary of Council Bluffs Local No. 336 (stage employees), business agent of Film Exchange Local No. 47, and big brother to Film Exchange Local B-47. In his spare time, he advises us, he tries to make a living working in the 20th Century-Fox screening room. At the present time he is busy making arrangements for the coming Nebraska State Convention.

● Alfred Weatherby, working a one-man projection shift at the Orpheum Theatre in Ortonville, Minn., succumbed to smoke inhaled while trying to extinguish a fire that broke out in the projection room during a war bond premiere. Realizing, no doubt, that the audience in the crowded theatre would become panic-stricken if an alarm were turned in, Weatherby fought the flames singlehanded and continued with the show. Several hours later

he died of lung congestion, a condition brought about, stated the attending physician, by smoke inhaled fighting the flames.

We understand that the Sixth War Loan Committee sent lovely flowers to the Weatherby family and is considering a posthumous award. That should make Alfred Weatherby very happy!

● A new York real estate firm operating a popular night club recently completed plans for the addition of a projection room providing for extra entertainment for their customers. From authoritative sources we learned that the plans provide for the installation of television equipment in the post-war period. The room is air-conditioned and is attractively decorated with mirrored walls and ceiling. Pictures are shown on a full-sized screen.



Lester Isaac

The modern sound equipment was installed under the direction of one of the most capable and best-known projection supervisors in the country, Lester Isaac, supervisor of projection for Loew's, Inc., and his very able assistant, M. D. O'Brien.

● Last month we paid a visit to the offices of Local No. 110, Chicago, and spent quite some time with the officials of the local. From our observations as an old-timer in the business, we were very much impressed with the co-operative spirit that prevails there. Jim Gorman, president, Gene Atkinson, business agent, and Clarence Jalas, his assistant, seem to have union affairs in fine working order.

In presenting his 1944 report to the local membership, business agent Atkinson cited the improved conditions inaugurated during the first year of his administration. We shall present a few of the highlights:

(1) *For the first time in the history of Local No. 110, all theatres in its jurisdiction have been unionized.*

(2) *At the insistence of union officials many exhibitors have corrected unsanitary conditions in their projection rooms, installing lavatories and running water where there had been no such facilities before.*

(3) *Collected back pay due the members.*

(4) *Secured increased pay for the members amounting to more than $400,000.*

(5) *All new contracts call for vacations with pay.*

(6) *Signed contract with Ideal Pictures Corp. whereby only Local 110 projectionists will be permitted to show their 16-mm pictures.*

(7) *Placed 32 extra projectionists, at increased salaries, with the various showings of the picture "Song of Bernadette."*

(8) *A television school where the fundamentals of the art will be taught Local 110 members is now being organized.*

In addition to union business, the officials of the local participated in the various drives, Red Cross, War Loan, Xmas Seals, etc. The local went over the top in the 5th War Loan Drive by subscribing for $176,386 in war bonds, oversubscribing its original goal of $150,000. However, in the last—6th War Loan Drive—Local 110 beat its own top record by subscribing for $270,846 in war bonds.

In speaking with a number of the so-called "opposition" members, all of them, without exception grudgingly admitted that the present administration was doing a "bang-up" job (as one of the men expressed it) in putting Local 110 back on the map as one of the truly progressive locals in the International Alliance. That is high praise indeed!

● We regret to report the death of Harry Cassidy, business agent of Local No. 159, Portland, Ore. Cassidy was a popular figure at I. A. Conventions and he will be sorely missed by his many friends.

● Many I. A. members were present at the recent convention of the Television Broadcasters Association (a report on which appears elsewhere in this issue). Representing Local No. 182, Boston, were Thad Barrows and Joe Rosen; Houston Morton represented Local No. 199, Detroit, Mich.; J. C. Skinner, Local No. 279, Houston, Tex.; Jesse Hopkins, Charlie Kellner and Herman Lampert, Local No. 306, New York City, and Victor Welman, Local No. 160, Cleveland, Ohio. We also ran into our old friend, Nat Golden, chief of the motion picture division of the U. S. Department of Commerce, who was very much interested in the proceedings.

● In appreciation of thirty years faithful service, the members of Local No. 224, Washington, D. C., unanimously awarded an honorary life membership card to their third vice-president, Thomas A. Reed. The presentation took place at the union headquarters and was witnessed by the entire membership and many I. A. officials from all parts of the country.



Thomas A. Reed

Tom Reed has held the office of president, business agent or treasurer consistently since his obligation into the local in 1912. He has attended every I. A. Convention for the past twenty-five years, and is an active delegate to the 4th District Conventions and the Central Labor Union meetings in Washington. For many years he advocated strict license and safety regulations in Washington and recently was appointed a member of the License Examining Board of the Government for the District of Columbia.

Reed's oldest son, Thomas R., a member of Local 224, is serving on the western front with Special Services, U. S. Army, and Alton, the younger, is in the Navy somewhere in the Pacific. Two sons-in-law are also with the armed forces overseas.

Although Reed has devoted over a quarter of a century to his work, he is far from finished with union affairs. He plans to continue with his projection work and his union activities for a long time to come. We take off our hat to Tom Reed, a loyal unionist and a swell all around guy.

● Orin M. Jacobson, I. A. representative and secretary of District Number One, covering the states of Oregon, Washington, Idaho, Montana, and the province of British Columbia, Canada, seems to have found the solution to the Booth Maintenance and Preparatory Time problem that has been and still is such a headache to many I. A. local unions.



O. M. Jacobson

In applying to the 12th Regional Board in Seattle, Wash., for a ruling covering the aforementioned, Jacobson pointed out that no increases were involved, that the employer had the right to ask his projectionist to report for work prior to actual show time for the purpose of preparing the show for screening, etc., and/or ask him to put in whatever amount of hours per week in maintaining projection room equipment that may be deemed sufficient. Both items, however, are in the same category—*extra time worked*. It is the same, pointed out Jacobson, as though the employer told the projectionist to start the show one, two, or three hours earlier than usual.

Needless to say, this ruling was acted upon favorably and since then many other I. A. locals in District Number One have successfully negotiated for extra pay for booth maintenance and preparatory time. Congratulations to Orin Jacobson for a swell job. We trust the day is

(*Continued on page* 20)

AT YOUR SERVICE

This department is a collection of random thoughts and some not so random: fact, fancy and opinion relating to the man behind the man behind the gun—the serviceman. The prime purpose of this section is to promote a closer relationship between serviceman and projectionist based on a better understanding of their mutual problems through an exchange of news and views, kinks and kicks. To this end, contributions relative to any phase of the serviceman's activities are invited.

Warning Device

Set an explosive rivet, such as is made by DuPont for airplane construction, in hard-to-get-at places on each of the motor generator bearings. If the bearing heats up "bang" goes the rivet which is exploded by heat. This rivet can also be used in any place where a warning is required in regard to excessive heat.—R. H. Hecht, *RCA.*

Repairing a Transformer

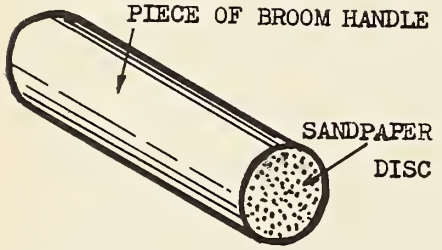
High voltage transformers used in sound systems can often be easily repaired. In several instances I have found that when an open occurs in the high voltage winding, very often the open can be found at or near the point where the fine secondary wire is soldered to the heavier lead. I recently salvaged a transformer in this way.—R. H. Bisbee, *RCA.*

Preventing Oil Creepage in Projector

If the inside of the projector on the operating side is cleaned and given a coat of liquid wax the oil will not creep out of the bearings. One application will last about six months.—W. R. Hill, *RCA.*

Maintenance of Tube Contacts

A tool for cleaning socket contacts of Edison, Mogul, etc., can easily be made by sawing about four inches off the end of a broomstick, making a neat and square cut (see illustration below). Glue a disc of sandpaper to one end and then



rotate the tool in the socket hole.

Much noise is introduced into sound equipment by engineers who remove the nickel finish from tube prongs with sandpaper, thereby exposing the brass underneath. Brass and copper are bound to tarnish and an endless vigilance becomes necessary. Steel wool is an excellent medium as a brightener as it removes dirt and does not harm the metal. It removes stains and discolorations from enameled surfaces without affecting the enamel finish.

Contacts made of plain coin silver receive little mention and yet are extremely reliable in the writer's opinion. The latest uses, which worked perfectly, was to make a little rider that fitted loosely over a rheostat contact arm for correcting heating and erratic conditions. —A. F. Schneider, *RCA.*

Removing Sprockets

Chamferring the outer ends of the constant speed shaft and applying a drop of light machine oil will aid in the ready removal of a sprocket when it is due for a replacement. This also applies to other shafts and sprockets but it has been my experience that the constant speed sprockets give the most trouble due to their sticking.—A. F. Schneider, *RCA.*

Using RCA-868 PEC in SH-7500 Soundhead

The SH-7500 soundhead can be modified to use on RCA-868 photo electric cell with the use of a socket adaptor. Using the base on an old SH-7500 soundhead cell and fitting it with a socket to take the 868, a decided increase in gain resulted with this installation.—H. W. Prosser, *RCA.*

Film Cement Applicator

A Speedball writing pen, size "A. O." makes a perfect all metal film cement applicator.—M. Rushworth, *RCA.*

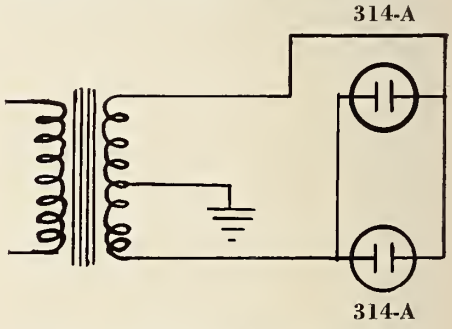
Improving SH-7500 Soundhead Operation

A rather common trouble with the SH-7500 soundhead is the rapid wearing of the motor drive shaft and gears which results in excessive noise. The manufacturers of this soundhead have designed a new type gear for replacement which is supposed to overcome this condition. For the benefit of those who have not yet encountered this trouble, I submit the following information:

When trouble of this kind is experienced, one SH-2765 pinion gear, one SH-7047 bakelite gear, and one SH-2758 long spacer should be ordered. These gears must be replaced in pairs as the new ones are of a different pitch. Also, when the replacement is made, the small balancing wheel on the pinion shaft should be discarded and the long spacer used to take up the extra space on the shaft. With the new molded rubber couplings, this balance wheel has been found to cause slight low frequency "wow" and is no longer necessary for a good performance. —A. H. Clow, *RCA.*

Modification of 12-Type Power Units

Due to power failures, I have experienced considerable trouble with the W. E. 314-A rectifier tubes. To overcome this condition, I installed another socket in



a 12-type rectifier unit and am using two tubes instead of one. These tubes are so wired that if one tube should fail to function the other one will carry the full load. For best results the tubes should be matched as closely as possible.—C. L. Swinney, *RCA.*

Improvised Wrench for Removing RCA MI-1040 Soundhead

The following information is passed on for what it may be worth to inspectors required to remove Simplex heads from RCA 1040-type soundheads. Although a special wrench for this type job is recommended, I found that a standard automobile type open end wrench, size 9/16" may be used. These wrenches are ½" on one end and 9/16" on the other end and are thin, approximately 3/16" at the wrench end. This is important as the *wrench must be thin* in order to get at the front ⅛" thick head. *Also open end.*

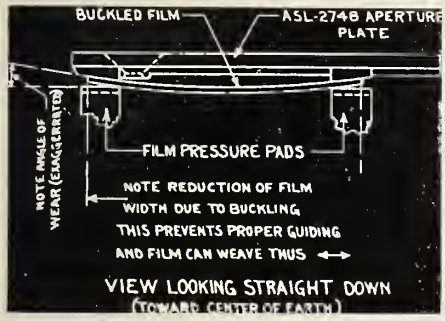
The screws need not be completely removed as the head can be moved toward the lamphouse and then lifted out of the large opening in the slots. Removal of the oil tube for the scanner

drive shaft and the metal cover protecting PEC wiring, where used, simplifies the job. Also note that the projector drive gear shaft screws into a nut on the operating side of the Simplex head —C. E. Maass, *ALTEC*

Worn Aperture Plate Causes Sprocket Hole Noise

Trouble was reported of alternate framing line and sprocket hole pick-up on *one* certain feature, and on only *one* machine. The same reels on the other machine tracked perfectly. Without going into the harrowing details, the sketch below shows the trouble. Flat film will track perfectly but there is absolutely no control over buckled film.

Normal inspection will not reveal this



defect; the aperture must be removed and a straight-edge placed across the pads. All plates in my territory are going to be inspected in this manner, and I'll say to the rest of the boys, "it could happen to you."—D. T. Van Alen, *ALTEC*

Prolonging Life of Monitor Speaker Cone

I have had excellent results in increasing the life of center supports on the No. 26402 cones of the monitor speaker in the PG-105 amplifier by installing a couple of washers cut from scrap film leader. The washers are cut large enough to cover about half the support. One is placed below and one above the support on the centering screw.—R. O. Northrop, *RCA*.

Conserving Test Equipment

To reduce the wear of tube tester sockets, adaptor plugs, etc., I keep a very light coating of vaseline on all of the contacts.—R. H. Bisbee, *RCA*.

Locating Amplifier Hum

Murmurring and a.c. hum were definitely traced to the carbon dust from the projector arc settling around the socket prongs of a driver stage pair of 45 tubes. The removal of this bluish-white film from around the sockets provided leakage from filament to grid and ended a lot of noise that was erratic and hard to locate. —A. F. Schneider, *RCA*.

Checking Condensers in TA-4151 Speakers

As a number of TA-4151 speakers are still in use the following method of checking on the condenser in the field supply should be helpful.

If the condenser in the field supply is open, as I found in three recent cases, there will be a noticeable hum in the speaker. To check for this condition it is only necessary to short the speech leads to the TA-4151 speaker. If there is a noticeable hum it is due to improper filtering of the field supply which is

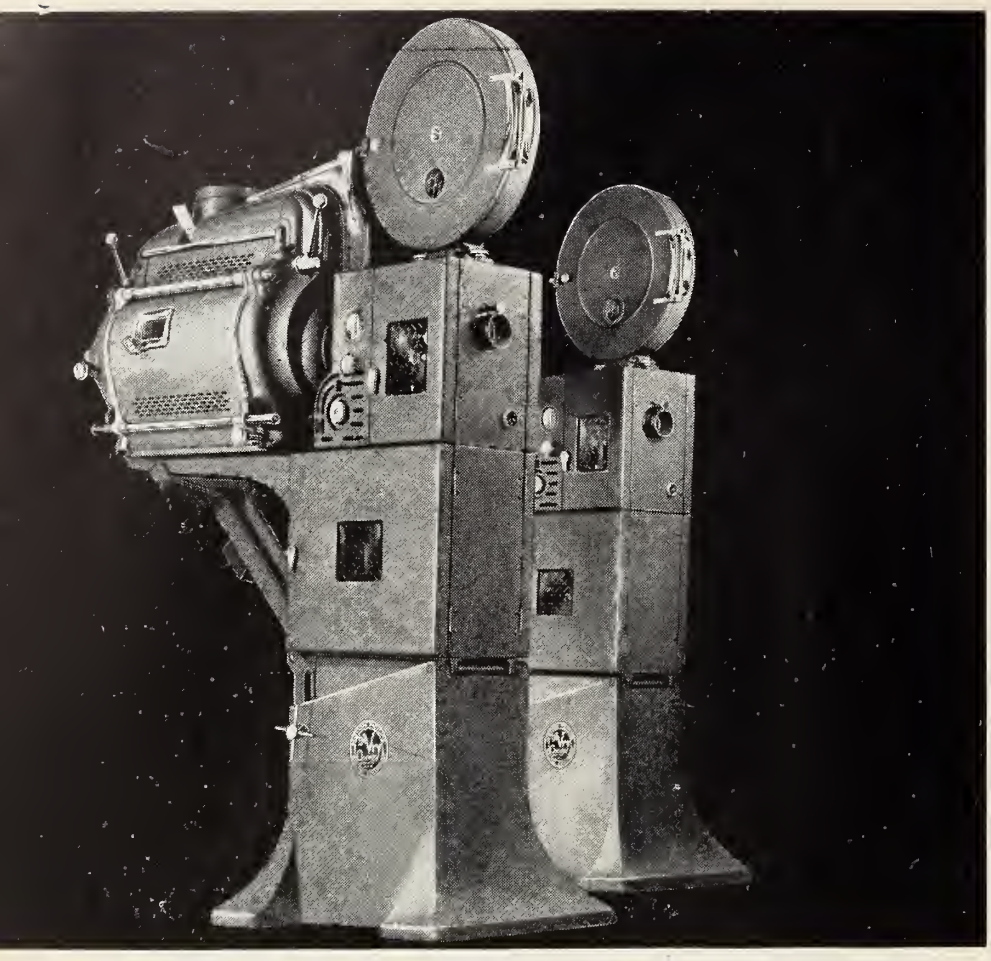
(*Continued on page* 25)

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IN THE SPOTLIGHT

(*Continued from page* 17)

not far off when every I. A. local union in the country will follow Jacobson's lead and put an end to the practice of projectionists putting in a couple of hours extra time each week without proper compensation.

● Clarence Jalas, assistant business agent of Local No. 110, Chicago, is taking over union affairs while business agent Gene Atkinson is taking a well-earned vacation. Jalas is very popular with the members and no doubt will carry on with the union business in very creditable fashion.

● We are familiar with many of the cute little schemes put forth by exhibitors in their efforts to reduce manpower in the projection room, but the one recently proposed by the St. Louis Motion Picture Exhibitors Committee takes the cake. The exhibitors offered to "loan" one projectionist from each theatre to a plant engaged in war work and to reimburse the men for any deficit in salary. Of course, after the war the projectionists will be returned to their theatre jobs, "*if necessary*," say these exhibitors. Meanwhile, they suggest that the statute calling for two men in every projection room be removed "in order that men of the skill and experience of these motion picture projectionists might be free to contribute to the war effort." Very cute but we really gave the exhibitors credit for being much more subtle than that. The real purpose behind their "patriotic" proposal is obvious. All they have to do is to establish a precedent, and the two-man law is permanently wiped off the statute books in St. Louis. We'll place our money on the officials of Local No. 143. We believe they are much too smart to be taken in by these flag-waving exhibitors. If these theatre owners are really sincere in their offer to help the manpower situation why don't they make the same offer to their managers, assistant managers, ushers, and other theatre employees?

● Boris Revzin, member of Local No. 306, New York City, for over 27 years is very proud of his three sons serving with our armed forces. Sgt. Meyer (Mike), the oldest son and a member of 306, is with the Signal Corps stationed in New Guinea; Cpl. Alfred E. (application man in 306) and the youngest, Lt. Stanley A. are still in this country awaiting orders to go overseas. As a father of three fighting men, Boris, we salute you!

● After considerable stalling, the Republic Pictures Corporation finally signed a contract with Local No. 306 calling for two men, plus a relief man, for the home office screening room. Realizing the utter futility of further negotiations with this

company, who had been delaying negotiations upon one pretext or another, Local 306 president Herman Gelber took drastic but very effective steps to bring matters to a head. Notices were sent to all members of the local and to all theatres in the local's jurisdiction that after a given date no Republic pictures would be permitted to be handled by Local 306 men. This made the Republic officials realize that 306 meant business and it was a matter of but a few days when the contract was signed and the matter settled. Score one for Herman Gelber, president of Local 306!

● The "know-it-alls" are going around saying that theatre television is a dead issue. To offset this assertion Paramount has made application for a series of tele stations in New York City, Buffalo, Los Angeles, Detroit, Des Moines, El Paso, Dallas and Chicago.

● Milton Lowe, member of Local No. 1, New York City, and chief electrician at the Broadway Theatre, has found an outlet for his spare time. He recently opened his own sound supply shop and solicits the business of his brother members.

8% BOOST IN CLOTHING PRICES

The cost of living index shows clothing prices to be taking the lead in the upward swing. It increased some 8 per cent during the past year. This, according to the Office of Price Administration, is too much, and it is indicated by that war agency that something is going to be done about it. This action is expected momentarily, and it will be a welcome one showing that Washington actually means what it says when it talks about "holding the line" on prices.

HEIDENREICH NAMED BY RCA

Max N. Heidenreich has been named sales manager for RCA 16-mm equipment in the fifteen southern states, it was announced by J. W. Cooke, southern regional manager for the RCA Victor Division. Until recently he was a commercial engineer in the Camden plant. He will make his headquarters at the Atlanta office, carrying out dealer organization work and the encouragement of better utilization of audio-visual aids in the commercial and educational fields.

RCA SERVICE COMPANY OFFERS TELEVISION HANDBOOK

RCA Service Company has prepared a comprehensive and profusely illustrated handbook on the what, how and why of theatre television for theatre managers and projectionists, according to W. L. Jones, vice-president.

It is pointed out that rapidly growing interest in this new potential entertainment medium has resulted in many requests for lectures on the subject. Due to the difficulties existing today in carrying out such a program it was felt that a book, containing much of the lecture material which has been prepared, would best meet present-day requirements and provide much valuable information to industry members generally.

While the contents are devoted primarily to technical discussions of the reception and large-screen projection of television programs several chapters deal with such non-technical subjects as television commercial possibilities, the handling of programs, and audience response.

Entitled "Theatre Television Handbook for Projectionists," the book is being mailed without charge to theatre owners, managers and projectionists upon request to the RCA Service Company, Camden, N. J.

GEN. E. (TED) P. CURTIS GETS DSM FOR SERVICE

The Distinguished Service Medal has been awarded to Brig.-Gen. Edward P. Curtis, sales manager of the Eastman Kodak Company's motion picture film department, who is on leave to the Army. Gen. Curtis is one of ten generals to be so honored, and the award was made because of his service as Chief of Staff of the United States Strategic Air Forces in Europe from January to October, 1944.

Gen. Curtis was given leave in January, 1942, to work with the War Department. He was then a colonel and later joined the Air Forces and went overseas. He was promoted to his present post in June, 1943. He was shot down in a bomber in Italy but was uninjured. Afterward he was appointed as chief of staff for Maj.-Gen. Carl Spaatz.



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March of Dimes to Fight Polio

THE March of Dimes fund this year again will fight poliomyelitis on a double front: educational and epidemic, according to the National Foundation for Infantile Paralysis, which is making its annual appeal this year Jan. 14-31. To help parents, teachers and community leaders cope with outbreaks of infantile paralysis, the National Foundation last year published and distributed free of charge—through health offices, settlement houses, insurance companies, and its national office—more than 600,000 copies of a bulletin of helpful hints, "When Polio Strikes." This bulletin describes the symptoms of polio and indicates the necessary precautions that should be taken.

Basil O'Connor, president of the National Foundation, is sure that the wide support of the past year to the fund will be equaled or exceeded this year.

Another educational medium which has proved its effectiveness in epidemic emergencies is the radio. Last year, before the polio epidemic season, the radio department of the National Foundation prepared a radio script dealing specifically with what the public can do to aid local health officials in combatting infantile paralysis epidemics.

The National Foundation last year allocated more than $1,600,000 for research on poliomyelitis to universities and hospitals to be carried on in the fields of virus research, after-effects and education. Under these grants many of the nation's finest scientists now are trying to unravel the mysteries of infantile paralysis in more than fifty institutions over the country. In the educational field, a special fund of $50,000 for fellowships in health education was set up to provide men and women professionally trained in public health work who will aid the nation's army of polio fighters.

Under the guidance of the National Foundation, all this work is made possible by the money contributed by Americans to the annual March of Dimes appeals. It is hoped that this year even a greater amount will be channeled into universities and hospitals carrying on this vital research. Keep America strong—send your dimes and dollars to The White House.

MOTIOGRAPH GETS NEW CONTRACTS FOR ARMED FORCES

Motiograph recently was awarded some additional prime and sub-contracts to produce for the armed forces many new items of radio, radar and gun fire control apparatus, it is announced by the company. These will keep the three plants working at full capacity for the entire year. Though the company's monthly shipments are at the highest point in its 48-year history the company still is producing a limited amount of 35-mm motion picture sound and projection equipment for essential civilian users.

Over 2,000 employees and their immediate families attended Christmas parties at the three Motiograph plants.

I. A. Elections

L. U. 150, LOS ANGELES, CALIF.

Wallace G. Crowley, *pres.;* Harold Angel, *vice-pres.;* Charlie Vencill, *sec.-treas.;* George Schaffer, *bus. agent.;* Tommy Armentrout, *asst. bus. agent;* Magnus Nielsen, J. R. Pylet, R. Haskell, C. Piper, P. Mahoney, *executive board;* V. Crowl, C. Bramel, R. Gregory, *examining board;* H. C. Smith, D. B. Levitt, C. Crowe, *trustees.*

L. U. 154, SEATTLE, WASH.

Fred Jiencke, *pres.;* Thomas Watters, *vice-pres.;* Harold Simpson, *sec.;* Ross Hirth, *treas.;* Jim McNabb, *bus. agent;* Robert Cameron, *chairman, board trustees.*

L. U. 165, HOLLYWOOD, CALIF.

Walter R. McCormick, *pres.;* Harold C. Roddan, *vice-pres.;* C. Richard Silver, *sec.-treas.;* C. W. (Pat) Offer, *bus. agent;* Donald Rudd, Allen Tinker, Homer Mendenhall, Ace Snead, Fred Evans, *executive board;* Charles Groman, Fred Meyers, Harold Sailor, *trustees;* Harold Kenoyer, *sgt.-at-arms.*

L. U. 173, TORONTO, CANADA

Arthur Milligan, *pres.;* Arthur Kerrins, *vice-pres.;* George Jones, *sec.-treas.;* Pat Travers, *rec.-sec.;* Harry Dobson, Carol Wells, Jim Sturgess, *executive board;* Robert Irvine, Ed. Whyatt, Charles Andrews, *trustees;* Sol Cohen, *sgt.-at-arms;* George Robinson, *tyler.*

L. U. 182, BOSTON, MASS.

Thad C. Barrows, *pres.;* Joseph Nuzzolo, *vice-pres.;* Joseph Rosen, *treas.;* Albert R. Moulton, *fin.-sec.;* Halter Diehl, Harold Kaitz, James O'Brien, *executive board;* Joseph Ritchie, *sgt-at-arms;* Thad C. Barrows, *trustee.*

L. U. 224, WASHINGTON, D. C.

Jacob Lehman, *pres.;* Wm. Sheehan, *1st vice-pres.;* Herbert Mould, *2nd vice-pres.;* Thomas Reed, *3rd vice-pres.;* Malcolm Sparrough, *4th vice-pres.;* Ralph Grimes, *sec.;* LeRoy Hopkins, *fin.-sec.;* Forrest Ormes, *treas.;* DeWitt Bittenbender, *bus. agent;* George Denham, *guide;* Elmer Lewis, *guardian;* Julius Mayer, *trustee.*

L. U. 343, OMAHA, NEBR.

Alvin G. Kostlan, *pres.;* R. V. Morterson, *1st vice-pres.;* Ben Cuttle, *2nd vice-pres.;* B. A. Loomis, *treas.;* G. E. Jordan, *fin.-sec.:* Howard Jackson, *bus. agent;* Clyde Cooley, *sec.;* A. L. Frazier, *sgt.-at-arms;* R. Murray, W. F. Wermer, R. L. Harrington, *trustees.*

L. U. 348, VANCOUVER, CANADA

Bert Pollack, *pres.;* Robert McEwan, *vice-pres.;* J. H. (Hank) Leslie, *sec.;* Bob Foster, *bus. agent;* Tom Foley, *recorder.*

L. U. 376, SYRACUSE, N. Y.

Louis R. Boyd, *pres.;* Melvin Denny, *vice-pres.;* George Raaflaub, *rec.-cor.-sec.;* Lionel Wilcox, *fin. sec.-treas.;* Raymond T. Roe, *bus. agent;* Francis Miller, *sgt.-at-arms;* Walter Scarfe, Robert Poulsen, *executive board;* Lawrence Sherman, John Eccles, George Brown, *trustees;* William Maxon, *del. to I. A. convention.*

• BUY WAR BONDS •

L. U. 401, CENTRALIA, WASH.

N. D. Stark, *pres.;* Mike Greenleaf, *vice-pres.;* Russell Spiker, *sec.-treas.;* C. E. Staples, *Centralia-Chehalis bus. agent;* W. T. Marcuson, *Raymond-South Bend bus. agent;* Ross Kinsey, *Vancouver-Camas bus. agent;* R. Spiker, *Longview-Kelso bus. agent;* Walt Evers, *sergeant-at-arms.*

L. U. 414, WICHITA, KANS.

F. E. Welsh, *pres.;* E. L. Jeffress, *vice-pres.;* C. D. Peck, *sec.;* A. S. McBride, *treas.;* W. A. Lee, *bus. agent;* A. H. Murphy, *sgt.-at-arms.*

L. U. 528, KINGSTON, CANADA

Lawrence Heyman, *pres.;* George Clapp, *vice-pres.;* Arthur Sweet, *sec.-treas.;* Rodrick Davey, *bus. agent;* Wm. Richardson, *sgt.-at-arms.*

L. U. 735, MT. CLEMENS, MICH.

Dan Defenbaugh, *pres.;* Roy Suckling, *vice-pres.;* Jim Kimmick, *sec.;* George Konath, *treas.;* Bert Penzien, *bus. agent;* Ralph Brough, *sgt.-at-arms.*

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LETTERS TO THE EDITOR

16-mm Data Requested

To the Editor of I. P.:

Along with the renewal of my subscription I wish to suggest—and request—that future issues of INTERNATIONAL PROJECTIONIST contain as much technical and service information on sub-standard equipment as it is possible to obtain.

The constant increase in the use of 16-mm equipment is creating additional service for members of the I. A., and I am sure that your subscribers will greatly appreciate any help received from your publication.

PAUL WALLACE
Fresno, Calif.

(EDITOR'S NOTE: *I. P. has long realized the importance of 16-mm projection and articles on the subject are published in the magazine from time to time.)*

Appreciated

To the Editor of I. P.:

Enclosed find $3 for a copy of the PROJECTIONIST SERVICE MANUAL.

I was a projectionist in North Dakota for over ten years prior to my enlistment and am doing the same work in the army. In the army, however, we have to make our own repairs and this is where the MANUAL will prove its value.

I get your Projectionist magazine out here and after reading each issue from cover to cover I pass it on to the next guy. He, in turn, passes it on after he has finished reading it, and so it goes on down the line. Keep up the good work you have been doing so that when we get home we will be able to pick up where we left off.

SGT. M. L. MUNSON
APO 980, Seattle, Wash.

Needless Waste of Film

To the Editor of I. P.:

Your article in the October issue of I. P. relative to conservation of film interests me very much as I believe it is the duty of every projectionist to do his part in saving as much film as possible.

Several months ago I put into practice a plan which I have been following ever since. Many theatres that use trailers of coming attractions attach these trailers to the end of the pictures being shown. In making up the show the tail of the picture has to be cut off and the trailer is attached. Two frames are cut off the print when the trailer is attached and two frames are destroyed when the trailer is removed and the tail of the picture is replaced. This makes a loss of four frames every time the picture is run. When the print passes through the hands of four projectionists it means that a foot of film is lost. Get a pencil and paper and figure out what a large amount of film is needlessly destroyed.

When I remove the trailers from the print I leave off the heads or tails of the prints and place them in the film can with a notice advising the next projectionist that the trailers for his theatre could be attached to the print without cutting off any more film. He, in turn, passes the print on to the next projectionist with a similar notice, etc. Each time the print is passed on in this manner, two frames of film are saved. If the projectionist who receives the print does not use trailers, all he has to do it to attach the tails or heads back on the print—or he may leave them off, if he wishes.

I personally think this is an excellent idea and would like to get the reaction of other I. P. readers to this method of conserving film. I look forward to receiving INTERNATIONAL PROJECTIONIST every month and enjoy it very much. It is a *must* with me.

CHAS. A. CHRISTOPHER
Stuart, Fla.

Projection Overseas

To the Editor of I. P.:

Please change my APO number to the one listed below.

I am stationed in Italy and I service some of the theatres taken over by the army. The first booth (if you could call it that) I walked into had one machine—35-mm—and barely enough room for one person. The army guy that runs this machine tries to get the whole show on one reel and most of the time the film extends from four to six inches beyond the top of the reel. His assistant is an Italian projectionist, who, despite the fact that he has been doing this work for over twenty years, still does not know how to change a sprocket! At one time a pin broke in the feed motor of the arc and he suggested taking it to the local repair shop where it would take five days to do the job. We made the repair in a half hour.

At the present time I am doing repair work on 16-mm machines and that is a full-time job. You have no idea how many fellows there are around who *think* they can service these machines. They mess around with them, and one of them removed the power transformer saying that it was burned out. I replaced the transformer and the amplifier worked fine—I never did find out what was wrong with the machine in the first place.

Other so-called projectionists do not like the way the manufacturer puts the amplifier together and they either remove some of the parts or else re-design them—why, I don't know. I could cite you many instances like this and if you care to get any more letters along this line, let me know and I will shoot them along.

CPL. JOHN THORMAN
APO 528, N. Y. C.

AT YOUR SERVICE

(*Continued from page 19*)

picked up by the hum bucking coil. It is not necessary to go back stage to make this check, merely short the speech leads in the projection room, then step out in the auditorium and listen for hum. If you still hear it, go back stage and single out the offender.—C. E. MAASS, *ALTEC.*

Checking Fuses

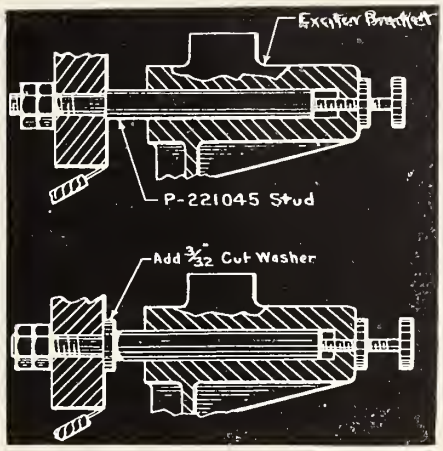
A white card about ½" wide and 3" long is just the thing for checking 1, 2, 3 and 6 ampere cartridge type glass fuses. Slip the card down in back of the fuse holder and this will show up the thin wire in the glass. Better still, this portion of the fuse holder may be permanently painted with white lacquer.—G. E. REIGER, *RCA.*

Correcting Soundhead Trouble

An unusual trouble was experienced with the SH-2027 lateral guide roller assembly SN-170 bracket freezing to the pilot shaft. It was necessary to use a gear puller to remove the assembly. No holes are provided in this assembly, and dirt collected together with oil was responsible for the binding of this unit. The hole in the white metal SN-170 casting was enlarged with a piece of emery cloth attached to the round shank of a screw driver.—D. W. MCMILLAN, *RCA.*

Replacement Pulleys for the W. E. IS-126 Drives

It is becoming increasingly difficult to obtain W. E. IS-126 drives used in idler pulleys as a tensioning device for the KS-6746 belt. A satisfactory substitute was obtained by purchasing a white metal pulley of the same size and removing the pressed fit graphite greaseless bronze bearing from the worn aluminum pulley and inserting it in the shaft hole of the new pulley. Very little machining is required, and although the new pulley has a V groove instead of a round groove, it gives excellent service.—D. W. MCMILLIN, *RCA.*



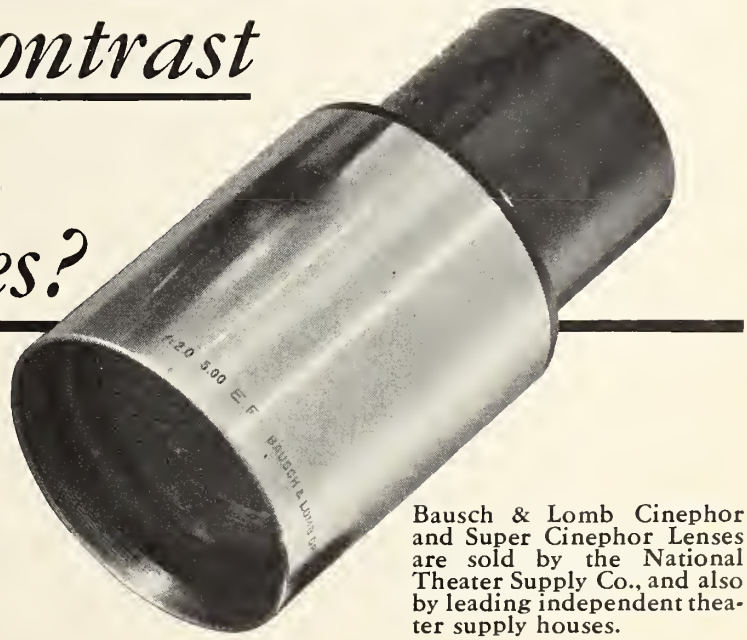
Modification of Supreme No. 592 Meter for Extended A. C. Range

Users of the Supreme No. 592 meter will find it to their advantage to add a d.c. range between the 7 volt and 35 volt scales. This can very easily be done without disturbing the meter wiring by adding two pin jacks in the top of the battery panel, with a resistor of approximately 7,000 ohms connected between them. This gives a 14 volt range for exciter lamps and the reading from the 140 volt scale. The resistor is put in series by means of a jumper and the 7 volt range button is depressed. A similar a.c. range could also be added by adding another resistor and one more pin jack.—M. RUSHWORTH, *RCA.*

How to Make Exciter Lamp Brackets Rigid on 206 Jobs

There are many cases where, due to long usage, the exciter lamp bracket in 206, 208 and W. E. reproducer sets seem to hang loose, and the exciter bracket seldom comes within 3/16" of the P-221045 stud on the inner end. In such instances I add a machine cut washer of about 3/32" between the stud and the wiring terminal, as shown in the above sketch. This, of course, brings the exciter lamp bracket further into the stud and makes the bracket more solid.—W. S. WELSHONCE, *ALTEC.*

Will Greater Contrast give you Better Pictures?



Sharper, clearer pictures reproduced on the screen with the same brilliance and contrast that is in the film are the result of using B&L Super Cinephor f:2.0 Projection Lenses. Because they are "Balcote" coated—the revolutionary new B&L lens coating that reduces "flare" and reflections and permits the passage of more light—they permit screen images that are not "washed out" by light reflections inside the lens system. Precision anastigmatic correction adds to image quality because it insures critically sharp reproduction over the entire screen area.

For the same qualities in longer focal lengths ask for Cinephor Series II . . . for a moderately priced lens with excellent correction ask for Cinephor Lenses f:2.0 or Cinephor Series I Projection Lenses.

Production for victory has unquestioned priority. While this may cause inconvenience, delay, and sacrifice in filling civilian orders we know it has the unqualified endorsement of everyone with whom America comes first.

Bausch & Lomb Cinephor and Super Cinephor Lenses are sold by the National Theater Supply Co., and also by leading independent theater supply houses.

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EST. B&L 1853

WILLIFORD IS VICE-PRESIDENT OF GENERAL ANILINE & FILM

E. A. Williford, general sales manager of the carbon products division of National Carbon, Inc., has been named vice-president in charge of the Ansco Division of General Aniline & Film Corporation, George W. Burpee, president, announces. Mr. Williford



E. A. Williford

has been associated with National Carbon for 24 years. The Ansco Division, which employs about 4,000 at its main plant at Binghamton, N. Y., manufactures photographic products, and during the war has also been producing wartime precision instruments, having suspended temporarily the manufacture of cameras.

Mr. Williford, upon his discharge from the U. S. Army as captain in 1920, immediately joined National Carbon, and has for years been closely identified with the photographic field. He is a past president of the Society of Motion Picture Engineers, and a member of a number of engineering societies.

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W. E. TO PRODUCE TELEVISION TRANSMITTING EQUIPMENT

F. R. Lack, vice-president of the Western Electric Company's radio division, announces that the company plans to manufacture television transmitting equipment in the post-war period. He pointed out that during peacetime Western Electric is the manufacturing unit of the Bell System and a leading producer of radio broadcasting equipment. He also said that since Pearl Harbor the company has become the nation's largest producer of communications and electronic devices for the armed forces.

Mr. Lack indicated that an active program of television development will be undertaken as soon as war conditions permit, to supplement the plans for manufacturing television transmitters. Graybar Electric Company will distribute the post-war transmitting equipment.

ALTEC SERVICE NOTES

The B & K Circuit, Chicago, has signed for Altec service in its 81 theatres in Illinois and Indiana, with the deal being negotiated by Altec's Chicago district manager, R. Hilton. The Lincoln and King Coal Circuit has contracted for Altec service, according to Warren Conner, Cincinnati district manager. This mid-Western booking agency also has signed for service in 11 theatres in the Cincinnati area.

Bert Sanford, Altec New York district manager, announced that Paramount Pictures, Inc., has signed for service in the various theatres of the Netco Theatre Corp. He also announced the signing of Buffalo Theatres, Inc., for the servicing of their 12 theatres in the Buffalo area.

Renewal of service contracts with Pitts Theatres, Inc., Fredericksburg, Va., for 21 theatres located throughout Virginia was announced by Altec's Philadelphia district manager, D. A. Peterson. In addition, Peterson announced that Neighborhood Theatres, Inc., and the Lewen Pizor Circuit also contracted for Altec service.

Agreements were renewed with the United Theatre Corp. for the 21 theatres comprising that circuit, according to Fred C. Dickley, Detroit district manager for Altec. In Atlanta, Ga., district manager H. B. Moog, announced that the H. B. Meiselman Circuit has contracted for Altec service.

CONTINUED ADVANCES IN LIVING COSTS

According to a report by the United States Department of Labor retail prices of living essentials increased 0.1 per cent on the average between mid-August and mid-September, with higher prices for autumn clothing and for house furnishings more than offsetting lower average costs of food. It was pointed out that the Bureau of Labor Statistics index for the cost of living for September, 1944, is 126.5 per cent of the 1935-39 average.

Prices of living essentials at retail are 2.1 per cent higher than a year ago, the department states. Almost all of this rise has been in clothing, house furnishings, and the cost of services, with food costs slightly less than in September, 1943. Rents in large cities are up 0.2 per cent over the year.

Continued advances were reported in clothing prices, with scarcities in children's clothing, underwear, house dresses, work clothing and other cotton articles. During the month there was an increase of 1.4 per cent in clothing prices, which now average 6.7 per cent higher than in September a year ago. It is pointed out that most of the increase is due to the disappearance of low price merchandise.

It is interesting to note, in connection with the study, that the Office of Price Administration this month went on record as being determined to reduce the price of clothing. Even when production costs rise, it is said, increases will be absorbed by manufacturers, jobbers and retailers.

In its report the Department of Labor said that prices of fuel, electricity and ice were unchanged, and are now 2.0 per cent higher than in September, 1943, principally due to higher prices for coal. There was little change in rents in large cities from June to September, 1944. The housing shortage, however, is still acute, especially in the war centers, with continued reports of forced sales to tenants.

NEW STAMP ISSUED FOR 50TH ANNIVERSARY OF MOVIES

Philatelists are rushing to obtain the new U. S. Government postage stamp issued recently to commemorate the 50th anniversary of motion pictures. Appropriately, the new issue depicts a scene in which America's sons and daughters on foreign combat duty attend a movie show put on for their entertainment in a back-of-the-lines jungle post.

How Many?

Was this copy dog-eared when it came to you? How many men read it ahead of you?

You would receive a clean, fresh copy *if* you had a personal subscription—and you wouldn't have to wait—you would be first to read it.

Use coupon below.

INTERNATIONAL PROJECTIONIST,
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Enter my subscription for
☐ 1 year—12 issues—$2.00
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Peace terms every man should make NOW!

The war is still on . . . and will be for some time to come.

But right now—before the war ends—every man in America has an unprecedented opportunity to make terms with himself for his own peace . . . his peace of mind.

For *now,* as never before, a man should look at his wife and family and say, "What can I offer them for the future?"

Now, as never before, a man should look at his house and worldly goods and say, "How can I improve these so my family may better enjoy life?"

Now, as never before, a man should look at tomorrow and say, "How can I best prepare for some unforeseen emergency which might affect my family?"

And *now,* as never before, every man in America has a chance to answer all these questions—an opportunity to provide for the future.

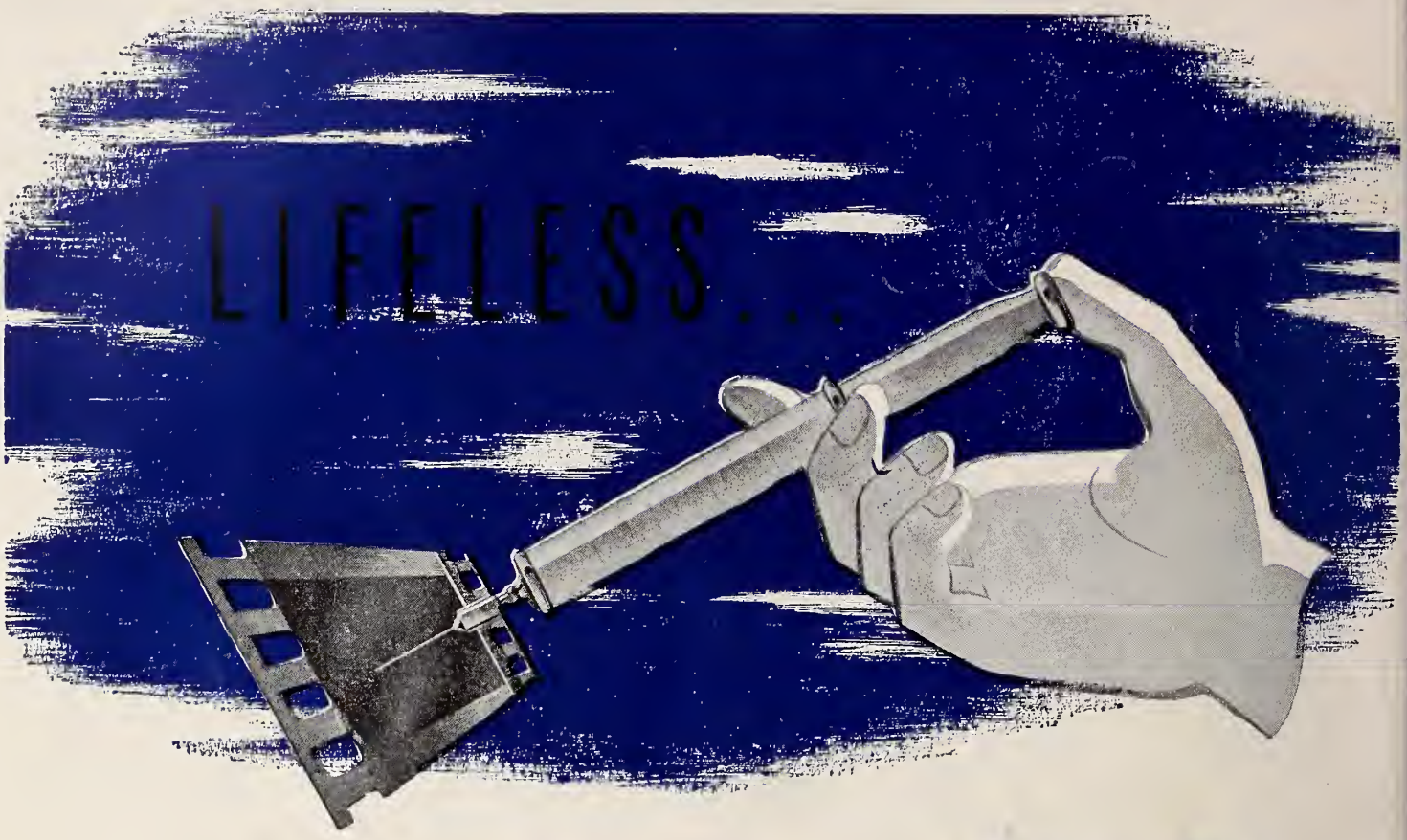
That opportunity is War Bonds. No doubt you are buying War Bonds through the Payroll Saving Plan. Arrange to buy *more* War Bonds. All you can afford. *More* than you thought you could afford.

What's even more important—don't cash in those War Bonds before they mature. Stick them away in a safe place—and forget about them till you can reap the full harvest on them.

Now is the time to make your plans for peace of mind. It's something you owe yourself . . . owe your family. Buy War Bonds and hold onto them!

INTERNATIONAL PROJECTIONIST

This is an official U.S. Treasury advertisement—prepared under auspices of Treasury Department and War Advertising Council



UNTIL PROJECTED BY Simplex

To-night, before show-time, millions of feet of celluloid will lie lifeless in the magazines of thousands of projectors of the country's leading theatres. It will be waiting for the blaze of arc lamps, the pulsing of the current and the whir of the motors which will start the projectors.

A flick of a switch . . . instantly this cold, static film strip will be miraculously **injected with life.** The screen, white but a moment before, comes alive with living, talking human beings which, in the next hour and a half, will bring laughter and tears to millions . . . will sweep away for a moment the cares of a war-torn world and transport theatre audiences into the magic land of make believe.

For you, the exhibitor, whose obligation it is to deliver to your patrons the finest in screen entertainment, the projector is the very life force, the heart beat, of your show. For you there can be no second best . no class "B" equipment is good enough.

That is why, for over a quarter of a century, leading theatre owners the world over have chosen Simplex projectors. For with Simplex in their booth they know that they are providing the maximum in entertainment . . . delivering to their apprecative patrons everything that Hollywood put on the film.

Since the birth of motion pictures, exhibitors have looked to our products for leadership in projection. Tomorrow — as yesterday and today — SIMPLEX equipment will continue to prove that — BETTER PROJECTION PAYS!

Simplex — IN WAR AND PEACE — THE *INTERNATIONAL* PROJECTOR

NATIONAL THEATRE SUPPLY DIVISION

COMPLETE SOUND AND VISUAL PROJECTION EQUIPMENT

Simplex

INTERNATIONAL PROJECTOR CORPORATION



PROJECTIONIST

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APR 2

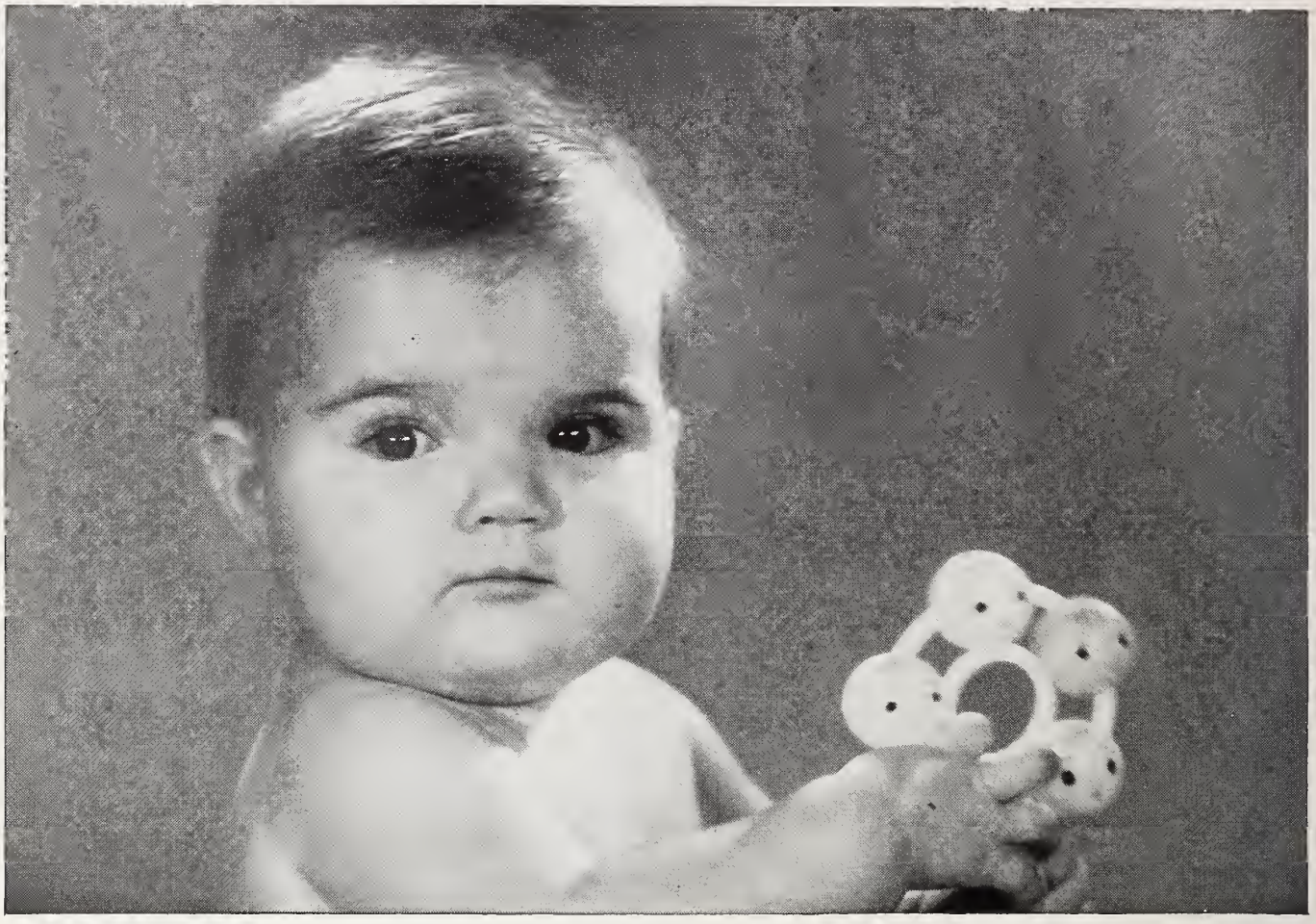
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WAR BOND MAN
— CLASS OF '63

Someday you'll want to see that boy, or girl, of yours off to college . . . and *right now* is not too early to start making plans.

Maybe your youngster, like so many other American boys, will work his way through school . . . but even in that case you'll want to be in a position to give him a little help if he needs it.

By what you put aside in War Bonds *today* you can help *make sure* he gets the same chance as other boys, *tomorrow*.

Chances are you're already on the Payroll Savings Plan. Saving as you've never been able to save before. This is fine not only for you, but for your country—*provided you keep on saving.*

But take your dollars out of the fight —and you will be hurting yourself, your boy's future, and your country.

Buy all the bonds you possibly can. Try to get even more than you ever have before. And remember this . . .

For every three dollars you invest today, you get *four dollars back when your Bonds come due.* You, and your boy, can use those extra dollars.

Make sure you get those Bonds! Hold on to them till they come due!

INTERNATIONAL PROJECTIONIST

★ *This is an official U. S. Treasury advertisement—prepared under auspices of Treasury Department and War Advertising Council* ★



MOTIOGRAPH

All those qualities you have wanted in a projector are yours in today's MOTIOGRAPH

Although it is impossible to produce enough Motiograph Projectors and Mirrophonic Sound Systems to meet current demands, we are taking care of those most in need of equipment.

Plant facilities have been trebled during the past two years, however, and peacetime production will greatly exceed any Motiograph schedule since 1896, with absolutely no relaxation of the celebrated craftsmanship that has made Motiograph famous. Superb performance, long life, moderate initial cost, and low maintenance cost have made Motiograph the outstanding name in projection.

Models of Motiograph-Mirrophonic Sound Systems, each guaranteeing the utmost in lifelike reproduction, are available for every requirement.

Your Motiograph Dealer will be glad to tell you all about this equipment, or you may obtain literature describing Motiograph Projectors and circular L72 on Mirrophonic Sound Systems by writing MOTIOGRAPH.

Since 1896 4431 West Lake Street • Chicago 24, Illinois

Cooperation Pays Off!



PROMPT REDESIGNING of projector carbons to wartime needs became essential, after Pearl Harbor. Long years of research and manufacturing experience enabled National Carbon Company not only to make the needed changes at once, but also to produce "National" carbons that gave virtually the same screen brilliance as before.

Aiding us was the welcome technical cooperation of exhibitor, projectionist, and lamp manufacturer. Throughout the many months of war, this cooperation has "paid off" for all concerned.

Of special importance is the "dividend" paid off to the war effort by the enormous quantities of copper saved through recovery of copper drippings and stripping of copper from carbon stubs.

Because of all these cooperative efforts, patrons have overflowed theaters everywhere for the beneficial relaxation of good movies.

Keep Your Eye on the Infantry . . .

the Doughboy Does It!

The registered trade-mark "National" distinguishes products of National Carbon Company, Inc.

NATIONAL CARBON COMPANY, INC.

Unit of Union Carbide and Carbon Corporation

UCC

General Offices: 30 East 42nd Street, New York 17, N. Y.

Division Sales Offices: Atlanta, Chicago, Dallas, Kansas City, New York, Pittsburgh, San Francisco

INTERNATIONAL PROJECTIONIST

With Which Is Combined PROJECTION ENGINEERING

W. L. Lightfoot, *Associate Editor*

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Monthly Chat

PRESIDENT ROOSEVELT has proclaimed March Red Cross Month, with the motion picture industry scheduled to exceed even its highly satisfactory responses of previous drives. While the roar of guns may cease it is a fact that human needs remain, and the Red Cross only can meet them with continued generous support. And all its support comes from voluntary contributions and gifts.

Many a month will pass after the official end of the war before all our fighting men are home, for some will be confined in hospitals for long periods of recovery, with Red Cross aid essential to their welfare and recovery. In addition the Red Cross also guards the welfare of the families of the men in uniform, as well as the refugees and waifs of war who need help.

Urgency of the appeal also is shown when it is realized that many other activities have to be continued, such as disaster relief, home nursing instruction, nurse's aid training, and many other activities.

• • •

In response to many requests from readers INTERNATIONAL PROJECTIONIST next month will inaugurate a series of articles by Aaron Nadell, editor-on-leave, analyzing the operation and maintenance of the popular 16-mm projectors. The importance of the 16-mm movie field has been progressively shown during the war period, with its post-war position being regarded as so important to the craft that widespread educational work already bas been started among locals and in the trade and technical press.

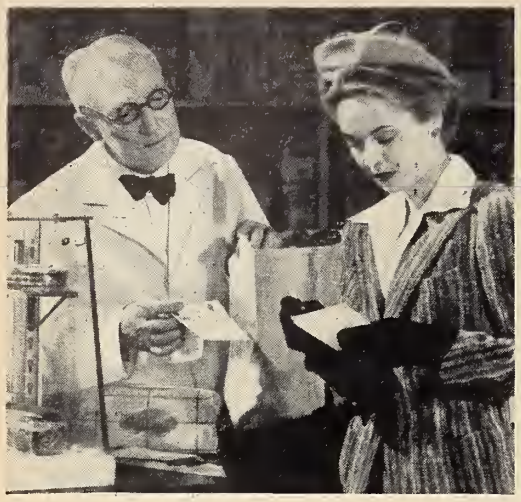
The first article by Mr. Nadell will deal with one of the leading 16-mm projectors, and will be followed frequently by other articles covering individual machines. Each of tbe popular models will be described completely, with many illustrations being used to show graphically their operation.

INTERNATIONAL PROJECTIONIST bas taken the lead in bringing to the field of projectiou up-to-the-minute data on 16-mm apparatus, and will continue to publish from time to time important articles and news of widespread interest.

Union leaders bave emphasized the point that a sound working knowledge of 16-mm projection will be of inestimable value in the post-war years, and projectionists who intend to occupy a leading position after peace is declared are those who are absorbing every bit of information available to them.

Publication of this first article, intended originally for the current issue, has been postponed through a delay in securing a complete set of illustrations. However, the initial study will appear in the March issue.

• BUY WAR BONDS •



The "shorts" she sees at the movies are a big help to the family purchasing agent.



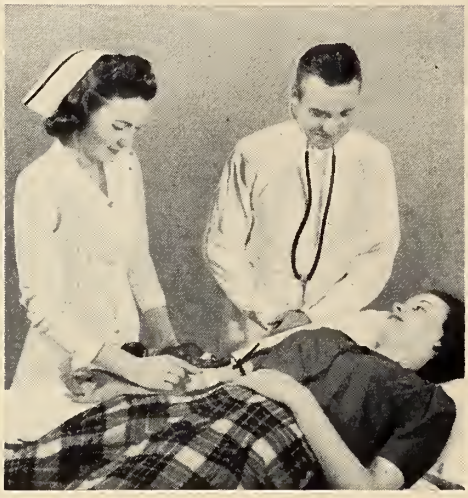
The non-stop War Bond and Stamp drive by exhibitors has brought in millions.



Many a WAC made up her mind to enlist . . . "at the movies."



Informational "shorts" remind the housewife that kitchen fat is indispensable to victory.



The movie houses of America sent thousands of blood donors to the Red Cross.



The movies "sell" the kids on getting in the scrap —and, what's more important, keep them sold.

WE'VE all been in this war so deeply, and for so long, that it's hard to remember back to the days when we thought that wars were fought by fighting men alone. One of the most important and most effective of the "recruiting officers" who are making this everybody's war is the motion picture exhibitor.

Hundreds of hours of theater time have been contributed to the showing of films designed to enlist men and women for the war plants . . . to recruit for the armed services, the merchant marine, and similar organizations . . . to help fight inflation . . . to keep the scrap tin coming in, and the kitchen fat and waste paper rounded up.

Millions have been collected for the War Funds. And when it comes to selling War Bonds and War Stamps, the exhibitors, their cashiers, and their volunteer workers not only have smashed quotas right and left during the drives, but have kept the money rolling in when the going is toughest—in between the drives.

Every war drive counts heavily on the exhibitor

One of a series of advertisements by KODAK testifying to the achievements of the movies at war



Eastman Kodak Company, Rochester, N.Y.

J. E. BRULATOUR, INC., *Distributors*
FORT LEE CHICAGO HOLLYWOOD

INTERNATIONAL PROJECTIONIST

VOLUME XX FEBRUARY 1945 NUMBER 2

Auxiliary Sound Requirements of the Motion Picture Theatre

By *HENRY B. SELLWOOD*

Scarcity of materials, suppliers and service men has presented projectionists with the opportunity of increasing their income by accepting full responsibility for the theatre's auxiliary sound services —sound reinforcement, hearing aids, lobby and mobile sound advertising, and so on. Projectionists are taking on these responsibilities in some cases, on a salary-and-overtime basis, and in other instances as independent contractors, making business deals for auxiliary sound with the theatres in which they are employed as projectionists. Some of the technical problems and requirements of auxiliary sound appliances are reviewed herein.

THE MOTION picture theatre no longer finds it a simple matter to hire a soundtruck or sound-equipped automobile to plug a picture. The theatre that does not have a hearing aid system and wants one may find some difficulty in getting it. The servicing of such auxiliaries is not a simple matter these days, particularly to those theatres that do not have regular sound and projection room service. Lobby loudspeakers, cry room sound facilities, microphone systems to reinforce live entertainment—all these now present serious problems both in equipment and in personnel.

New apparatus, whether wanted for an addition to the theatre's facilities or for replacement of something that has worn out, is likely to be hard to find. Manufacturers are now turning out radar and walkie-talkies, and battleship communicating systems, and very little of the equipment made in pre-war days will be found on dealers' shelves. Improvisation — making something else do — becomes more and more necessary both with respect to new facilities, and maintenance of old ones.

Manufacturers and supply dealers no longer have the personnel to offer the kind of service they gladly extended in peace time. The local radio man, who could always be relied on in such matters, is now apt to be very busy, very independent, and extremely high-priced.

More and more theatres seem to be turning for help in such matters to their own projectionists, who understand the elements of sound equipment, are always on the spot, and have a natural interest in the welfare of the theatre. More and more projectionists are deriving additional income out of this situation.

Some projectionists have preferred to enter into a dual arrangement with their theatres. As projectionists, they remain employees; with reference to auxiliary sound they become business men, contracting with the theatre that employs them. Others, however, prefer to function as employees on a wage and overtime basis in both connections.

Non-synchronous sound appliances in the motion picture theatre are used for the following functions:

1. *Sound reinforcement, via microphone, in connection with live entertainment.*
2. *Aids for the hard-of-hearing.*
3. *Cry room sound speakers—which must reproduce both synchronous and microphone sound.*
4. *Lobby or foyer arrangements to entertain standees who are waiting for seats to become available, and to advertise coming attractions.*
5. *Marquee speakers, where legal under local ordinances, for advertising and to attract attention to the theatre.*
6. *Mobile sound systems, on trucks or in automobiles, for advertising. A set-up in the use of wagons and other horse-drawn vehicles for this purpose is an interesting recent development. Antique coaches, when they can be found, are favored as a means of calling attention to some types of coming or current attractions. Sound equipment in such wagons and coaches is battery-powered.*

Ingenious showmen devise other and more or less novel uses for sound apparatus from time to time, especially in connection with exploitation. At beach

resorts the use of sound-equipped motor boats has been favored by exhibitors. These boats present special problems in loudspeaker-microphone feedback owing to sound reflection from the surface of the water and other factors.

Radio connection to the theatre's sound system, either to the synchronous system or the microphone amplifier, has been extensively employed to bring patrons news flashes, or special events of exceptional popular interest. And there never has been an event of such popular interest as the end of this war will be, when it comes. News reports on that occasion, radio announcements by the President and others in connection with it, will be piped through the loudspeakers of theatres provided with the necessary radio tuner and switching arrangements.

Auxiliary sound equipment in some larger theatres also controls patron traffic through such announcements as: "Seats now in the balcony only," etc. The only real limits to the uses of auxiliary sound apparatus are the imagination and ingenuity of the user.

Auxiliary Apparatus Units

The core and heart of all auxiliary sound equipment is an amplifier—an ordinary sound amplifier, not essentially different in any way from the one in the projection room, and therefore a device thoroughly familiar to projectionists. This auxiliary amplifier may not have special features relating to the particular work it is to perform. It may, for example, be a battery-operated device—circuits for which will be given in a future article. Other special features of one kind or another will also be diagrammed.

Since the object of the auxiliary amplifier is to produce sound of some kind, it must also have a loudspeaker or speakers; except in the case of the hearing and amplifier, which works into headsets. Furthermore, there must be a source of sound—microphone, phonograph pickup or radio tuner; the latter is only a radio without a loudspeaker.

Of course also there are switching arrangements, sometimes of such nature that the auxiliary equipment, or some of it, is temporarily connected with some parts of the regular projection room installation. For example, to reinforce live entertainment the regular amplifier may be used, with a line from the stage microphone switched to substitute for the photoelectric cell as a source of sound input, and auxiliary speakers substituted for the regular speakers. Again, hearing aid arrangements may involve use of a totally independent system, complete in itself from microphone to headsets, or may involve only a tap connection from the regular projection room amplifier, to which the headsets may be wired.

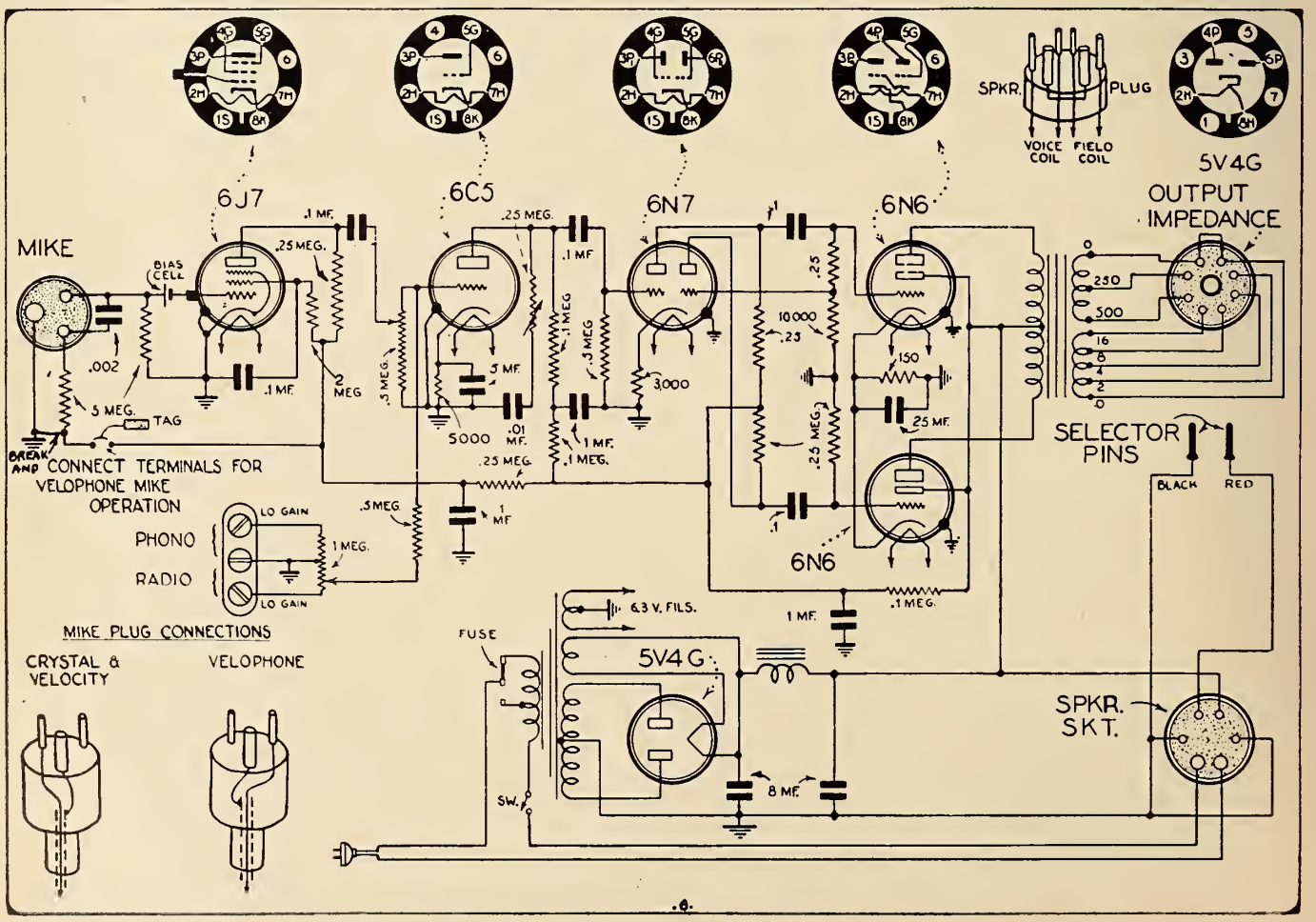
In all cases the auxiliary apparatus obeys the normal sound requirements with which the projectionist is familiar, such as maintenance of impedance match, necessity for good frequency response, adequacy of output wattage to the work the sound is to do, and so on. There are no principles involved that are strange to the projectionist although there are detailed problems in which his normal work has not given him very much experience. An example of the latter is the difficulty of avoiding acoustic feedback between loudspeaker and microphone.

Practical Apparatus

Figure 1 is the schematic of a typical public address amplifier suited to many auxiliary theatre uses. It is, moreover, of that type which can be adapted to work with a photoelectric cell if necessary, and therefore would do double duty in any theatre as an emergency replacement for the regular sound amplifier.

Loudspeakers connect to this amplifier through a multiple-terminal jack or socket seen in the lower right-hand corner; and a suitable matching impedance is selected by plugging two selector pins (extreme right, halfway down the draw-

FIGURE 1



ing) into suitable terminals of another multi-terminal jack (top, right). It will be noted that until the plug is inserted in the speaker socket (bottom right) the a.c. line will remain open and the amplifier will be inoperative.

A high impedance input device, such as a microphone, is connected by plugging into the jack at the extreme left of the drawing. Connections for photograph tuner or record-player are made by means of a conventional terminal strip, drawn under the 6J7 tube.

Details of the various plug connections needed to fit these jacks will be seen at the lower left and upper right of the drawing. Details of tube socket connections—those of the two output tubes being of particular importance—will be seen along the top of the diagram.

This amplifier has a rated maximum amplification of 125 db., and can deliver 15 watts, although there will be considerable distortion if that much power is drawn from it. The maximum gain available from the low-level input circuit (the phono-radio terminal strip) is rated at 90 db.

Power Circuits

The power circuits of this amplifier can be traced from the power source—the a.c. line plug shown at the bottom, near the velophone microphone plug. From the lower a.c. terminal trace right to the speaker socket. Note that the two bottom terminals of this socket are oversize. Now look at the speaker plug at the top of the drawing. Note that it has two oversize terminals, and they are short-circuited by a jumper. Hence when the plug is in place, the two large terminals of the speaker socket are joined, and the a.c. line can, therefore, be traced through these terminals, left, up through the power switch, through the primary of power transformer, through the fuse, and down to the other side of the a.c. plug, completing the power input circuit.

The fuse can be clipped into either of two positions to compensate for high or low line voltage. As drawn, the fuse is placed for somewhat high line potential. If it were clipped between the middle and lower plug, it would make connection through a smaller number of primary turns. There would then be a greater difference between the number of primary and number of plate secondary turns—a greater step-up ratio in the case of the plate secondary (and a smaller step-down ratio in the case of the filament windings). That positioning of the fuse would compensate for low line voltage.

The top secondary of the power transformer supplies current for the filaments of all the amplifier tubes; the secondary just below it powers the filament of the rectifier tube. The bottom, center-tapped secondary, is the high-voltage, plate-supply winding. Assuming the upper end of this winding to be positive at the moment, the rectifier and d.c. circuit can be traced: from that end of the winding to its associated plate, to filament, from the filament right up to the filter choke coil, thence right to the upper right-hand terminal of the speaker socket. Through the speaker field coil—see the connections on the plug for this socket, shown at the top of the drawing—back to the speaker socket right-hand terminal, thence right, down and left to ground.

Plate Power Circuits

A branch circuit with several sub-branches may be traced as follows: From the right end of the choke coil trace right about an inch, then up and right to the center-tap of the primary of the output transformer. Through that winding up and down to the two output plates of the 6N6 tubes. Also from the center-tap left and then up and down to the two input plates of the 6N6 tubes.

A further branch can be followed from the input plate of the lower 6N6 down, left through a 0.1 megohm resistor, further left and up, right up through 0.25 megohms to the left-hand plate of the 6N7. Also through the 0.1 megohm resistor left, up, right, down through 0.25 megohms, left, up and left to the right-hand plate of the 6N7.

Again: through the 0.1 megohm resistor left, up, left, up through 0.1 megohm and again through 0.1 megohm, left, and down to the plate of the 6C5 tube.

Returning again to the 0.1 megohm resistor drawn under the lower 6N6 tube trace left, up, left through 0.25 megohms, further left and up to the plate and screen resistors of the 6J7—which are 0.25 meg and 2 megs, respectively. Through these resistors to the plate and screen of that tube.

In all these plate supply lines, of course, the return to ground is through the cathode of the tube in question—directly to ground in the case of the 6J7; through a bias resistor to ground in the case of the other tubes.

In the case of the 6N6 tubes the circuit is not fully shown in this drawing. The actual internal arrangements of a 6N6 are *not* as indicated in this schematic; they will be found elaborated in the tube drawing at the top of Figure 1, just left of the speaker plug. However, even this more elaborate representation is incomplete; built into a 6N6 is a bias resistor connected between the two cathodes, thus providing a return for the d.c. of the right-hand or input plate of that tube. The operation of this form of tube will be completely traced as the discussion proceeds.

One last high-voltage d.c. branch remains to be traced. Return again to the 0.1 meg resistor drawn underneath the lower 6N6 tube. Follow left, up, left through 0.25 megohms, left, up, and left to a terminal that has a tag jumper shown just above it. Through the jumper to its associated terminal and then up through 5 megohms to the microphone socket. Through the microphone—this arrangement being for that type of microphone which requires high voltage d.c. excitation—back in at the left-hand terminal of the microphone socket, and down to ground. The short-circuit between the left-hand tag terminal and ground, shown in the drawing, is opened when this type of microphone is used. With other microphones the ground connection is left in place and the tag jumper removed from the two tag terminals, open-circuiting this d.c. supply line.

Grid Bias Circuits

Grid bias of the 6N7 is provided by a bias cell—a C battery of special construction, embodying materials of exceptional purity, so that it need not be replaced for a very long time. Since this cell keeps the control grid of the 6J7 negative at all times no direct grid current ever flows, and the overall drain on the battery is zero. The purity of its materials almost completely eliminates local action within the cell; thus its life is indefinitely long. In time, however, these cells do have to be replaced.

The grid bias resistors of the 6C5 and the 6N7 are drawn vertically just under those tubes, in series with their respective cathodes. When current flows through these resistors a voltage drop exists across them; they may therefore each be regarded as a source of voltage, which voltage is connected positive to cathode and negative to grid. The grid connection in the case of the 6C5 is from the ground contact at the bottom of the bias resistor left, up through 0.5 megohms (the volume control) and right to grid. In the case of the left-hand grid of the 6N7 trace from the bias resistor ground left, up through 0.5 megohms and right to grid. For the right-hand grid of that tube trace from grid right, down through 10,000 ohms to a ground contact: the negative bias is applied in reverse direction along this line.

For the 6N6 tubes, from the cathode of the upper tube trace left, down and right through 150 ohms to ground; from the lower tube cathode trace left, up and to ground through the same 150 ohms. For the grid side of this bias line trace from the lower 6N6 grid left, up through 0.25 megohms, and left to ground; from the grid of the upper tube trace left, up, left and down through 0.25 megohms, through 10,000 ohms, and left to the same ground contact. Nega-

tive bias is applied in reverse direction along these paths.

The 6N6 grids shown in this schematic are the input grids—the right-hand grids in the tube drawing at the top of Figure 1. A 6N6 tube is a two-stage amplifier in one envelope. The grid circuit thus far traced supplies only part of the bias to the input grids. From the right-hand cathode in the tube drawing there is (not shown) a bias resistor connecting to the left-hand cathode. That bias resistor is in series with the 150-ohm resistor referred to in the paragraph immediately preceding this one. Thus, two bias resistors in series provide the voltage drop for the bias of the input grids—the grid shown in the schematic.

The output grids—the left-hand grids in the tube drawing—are not shown in the schematic. They are biased positive, not negative, to the extent of the voltage drop in the built-bias resistor of the tube. There is thus a flow of grid d.c. in the left-hand section of the tube, and a greatly increased plate current in that section. The overall result is strong amplification, at the cost of some distortion; but a more compact and less expensive apparatus, owing to the fact that two tubes do the work of four.

Speech Circuits of Figure 1

Low-level, high impedance speech input may be traced from the upper right-hand terminal of the mike socket right, down through 5 megohms, and right to ground. The return is from the left-hand mike socket terminal straight down to ground.

The 5-megohm resistor then may be regarded as a source of voltage connected across control grid and cathode of the 6J7. From the plate of that tube trace right, down through 0.25 megohms, down, right and down to ground through 1 mfd. From the cathode trace directly to ground.

The 5-megohm plate resistor may thus be regarded as a source of speech voltage, connecting through ground and through 5 mfds. to the cathode of the 6C5; while its upper end connects through 0.1 mfd. and the slider of the volume control to the grid of the 6C5.

Now look at the phono-radio terminal strip, the center terminal of which is grounded. Phonograph or radio tuner speech output is wired to this strip with the grounded side of each line to the center terminal. To select radio input, move the slider of the 1 megohm volume control below the center-tap; to select phono input, move it above the center-tap. Each half of the volume control may be regarded a source of voltage, connected to the grid of the 6C5 through the slider, and to the cathode of the 6C5 through the ground connection.



Plate and cathode of the 6C5 couple, in much the same way previously traced, to the *left-hand* control grid and cathode of the 6N7. The left-hand plate couples through 0.1 mfd. to the input grid of the upper 6N6. The cathode of the 6N7 goes to ground through 3,000 ohms, and the cathode of the 6N6 goes to ground through 25 mfds., completing this speech circuit.

Now, from the left-hand plate of the 6N7 trace a branch speech circuit right through 0.1 mfds. and down, through 0.25 megohms and through 10,000 ohms, thence left to ground. From the point joining these resistors a line runs to the *right-hand* grid of the 6N7. It will be noted that the two resistors and this contact act, together, as a volume control with a fixed setting, and an extremely small part of the available volume—1/26th—is applied to the right-hand grid of the 6N7.

The amplifying action of the right-hand section of the tube brings this volume up again, so that the output volume of the two plates of the 6N7 is equal. But since the sound at the right-hand plate has undergone one additional stage of amplification, it is 180° out of phase with the sound at the left-hand plate. The right-hand plate is coupled through 0.1 mfd. to the input grid of the lower 6N6.

Thus, the function of the 6N7 is that of a phase inverter tube, in addition to that of an amplifier, and through its action push-pull input (180° out of phase) is applied to the input grids of the two 6N6's. The return side of all these circuits is through cathode and ground.

Now refer to the 6N6 tube drawing at the top of Figure 1. The input grid—the one shown in the schematic—is the right-hand grid. Regarding one plate and cathode of the 6N7 as a source of speech a.c., then 6N6 grid, 5G and cathode 8K may be regarded as the load terminals. But the circuit includes in series that resistor, not shown in the drawing, which links the two cathodes of the 6N6. As the space current through the right-hand side of the 6N6 fluctuates in response to the alternating speech potential drawn from the 6N7, the voltage drop through this undrawn resistor linking the two cathodes will fluctuate. That resistor can then be regarded as a source of speech a.c. connected between cathode and grid of the left-hand section of the 6N6. The output terminals of the left-hand section of the 6N6 are therefore 3P and 8K.

Return from the tube drawing to the schematic. Terminal 3P in each tube is that connecting to the top (larger) plate of each tube. In each case the load—connected across 3P and 8K, is a section of the primary of the output transformer. Speech current in these two halves of the primary will be 180° out of phase, or push-pull.

There are two primary secondaries, either of which is the source of output speech current, according to the way the speaker plugs are inserted. The speaker voice coil or coils may be regarded as the load connected to this output of speech a.c.

It will be obvious that this typical public address or auxiliary amplifier incorporates no electrical principles with which the projectionist is not already familiar, and very few departures in detail from the standard projection room amplifier circuits. Yet it is the kind of apparatus used for all sorts of auxiliary sound services in connection with a motion picture theatre.

In an early issue of I. P. this discussion of auxiliary sound services and apparatus will be resumed.

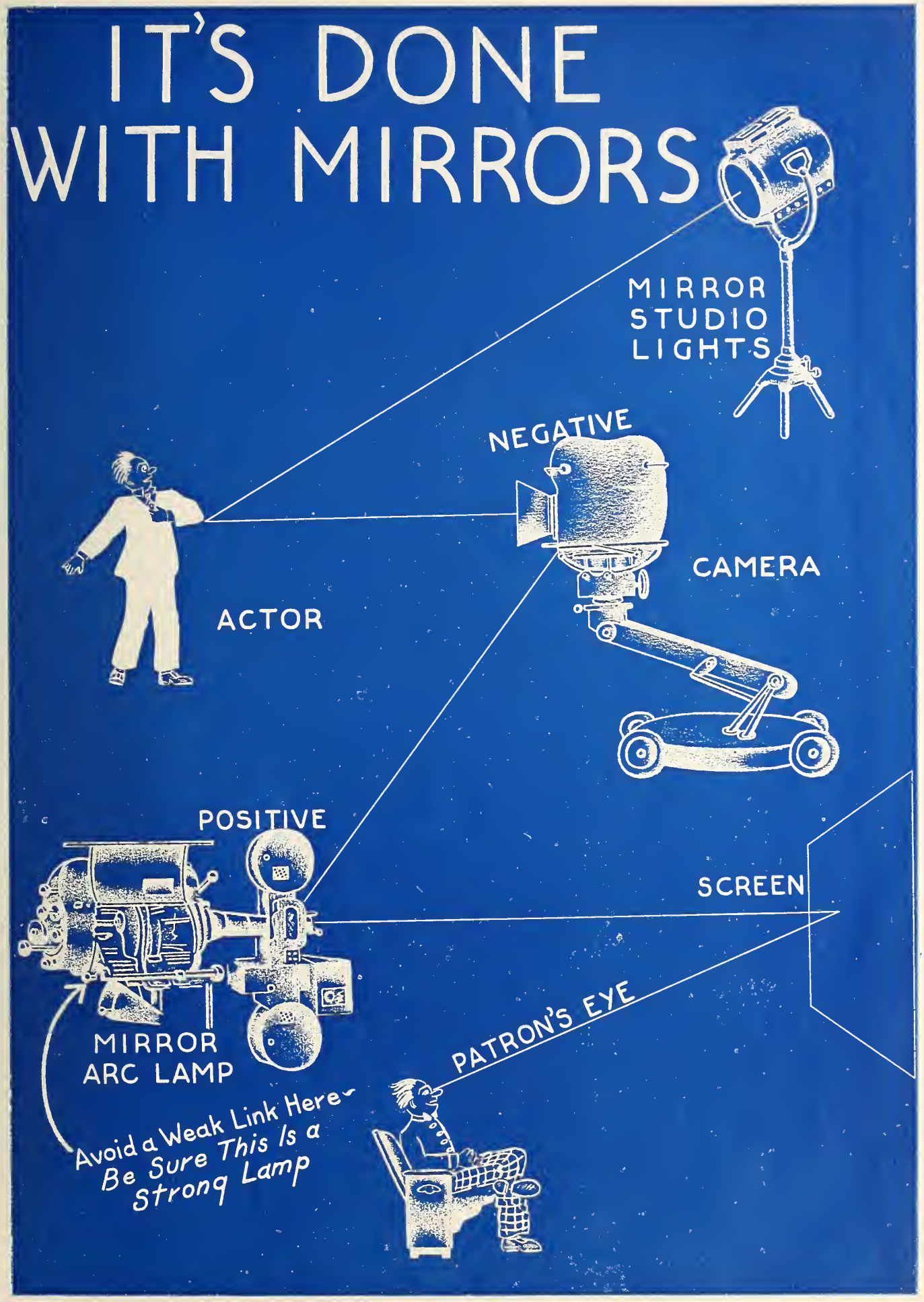
HUDSON GETS POST WITH RCA FOR 16-MM EQUIPMENT

Raymond A. Hudson has been named sales representative for RCA 16-mm equipment in the Eastern region of the country, according to an announcement by M. F. Blakeslee, New York regional manager for the RCA Victor Division. Mr. Hudson has been associated with RCA Victor as a 16-mm equipment specialist since July, 1944. Previous to joining the RCA organization he was for nine years actively engaged in the field of audio-visual education. He will make his headquarters at RCA Victor's New York regional office, 411 Fifth Avenue.

NEW DEVRY INSTALLATIONS

Norman Olsen, manager of the DeVry Corporation's export department, announces that the company's 35-mm projectors have been installed in two far-flung outposts of the motion picture industry. DeVry projectors were installed in a new theatre at Tananarive, Madagascar, and in the Lyric Theatre at Kodiak, Alaska.

IT'S DONE WITH MIRRORS



Characteristics of the Rechargeable Storage Flashlight Battery

By *CHAS. R. UNDERHILL, JR.*

RCA VICTOR DIVISION, CAMDEN, N. J.

THE Ideal (rechargeable) storage flashlight battery is a permanent type of flashlight cell of the well known lead-acid type. It was first introduced to the market about five years ago and has been accepted as standard by thousands of theatres, industrial plants, and individuals requiring daily use of flashlights.

This cell fits standard flashlight cases and takes the place of two 1¼" size D dry cells. It weighs only seven ounces and has a capacity of two ampere hours. Although the Ideal rechargeable flashlight battery has solved the dry cell shortage, it is not to be considered a temporary substitute because its use in flashlights definitely makes available more power for longer periods than is possible with dry cells. This striking contrast is illustrated in the curves of Figure 1. It will be recalled that it was the storage battery that made possible the modern automobile headlight.

Mazda lamps used in standard flashlights modernized with Ideal storage batteries are rated at 1.9 volts, 600 milliamperes (.6 amp.) It is for this reason that an unlimited amount of bright, steady light is always available no matter how much the flashlight is used. The ability of the lead cell to maintain a high-sustained voltage during the greater part of the discharge period makes this feature possible.

The care of the battery is simple and requires only an occasional few minutes to check and add distilled water when necessary. Protection against spillage from the battery in any position is secured by means of a cleverly arranged chamber and venting system, and semi-fixation of the battery electrolyte by use of a newly developed fibre packing surrounding the plates. This method of filling is shown in Figure 2.

The ever increasing use of storage flashlight batteries by motion picture projectionists, maintenance men, ushers and other theatre personnel prompted the writing of this article. We believe the readers of I. P. will be interested in the whys and wherefores of this handy projection room item and that the accompanying article will give them a better understanding of its care and maintenance.

The case is made of a red transparent plastic and is ruggedly built to withstand all normal hazards of flashlight service.

Actual field experience shows that with proper care this battery will give an average of 200 cycles of discharge and charge, although reports have been received of over 300 cycles of charge and discharge.

Charging is accomplished with an Ideal battery charger. This single unit a.c. charger (Figure 3) is equipped with a transformer and dry type rectifier. Charging current required is less than that used in running an electric clock. The rate of charging is controlled so that over-charging for hours does not injure the battery. An indicating lamp in the top of the small compact charger shows when the battery is charging.

Spring clips on the charger make contact for charging and also hold the battery in place. Gang chargers having six-cell and twelve-cell capacity operate on the same principle and several types are available for use with the various power supply sources. Three- and five-cell flashlight cases can also be adapted by means of Ideal spacer plugs designed so that one Ideal battery and one spacer plug will adapt a three-cell flashlight case. Five-cell flashlight cases can be modernized by using two Ideal storage batteries and one spacer plug at the same time changing the lamp to Mazda No. 365, (3.6 volt, .5 amp.) screw base.

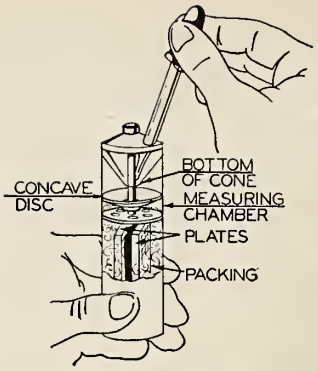


FIGURE 2

The cost of converting flashlights for use with storage batteries is low and is offset by the fact that one Ideal storage battery will outlast 400 dry cells. The number of light-hours of service in 200 or more cycles of discharge creates a large saving to regular flashlight users as compared with the use of the expendable type of cell.



FIGURE 3

Users of flashlights in large quantities who have this battery in routine service claim one discharge in heavy use is equivalent to the practical life of two dry cells which it replaces. Although the overall life of an Ideal storage battery is from one to three years, users have reported satisfactory service from their batteries for as long as four years.

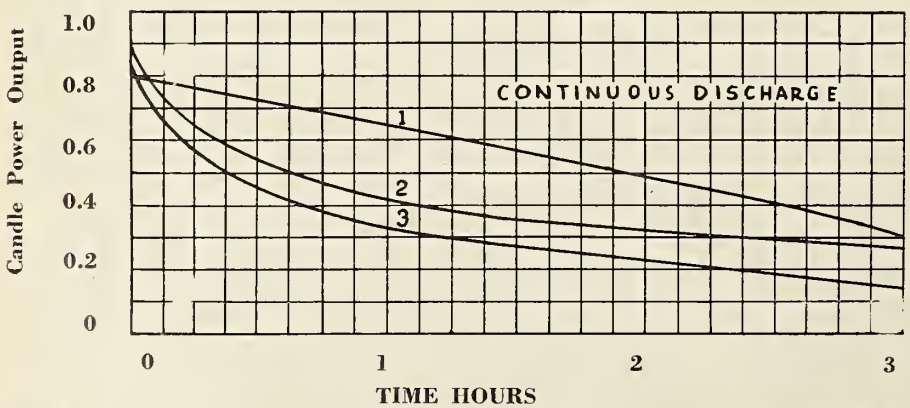


FIGURE 1. *(1) One Ideal flashlight battery; (2) two industrial flashlight cells; (3) two ordinary flashlight cells.*

NOW READY...

Projectionists'

$3.00 SERVICE MANUAL

How to Make Your Own Schematic and System Diagrams†

By *LEROY CHADBOURNE*

In this article, methods of making a schematic diagram from accumulated information are elaborated; and the uniting of several schematics into a unified representation of a complete sound system is discussed in detail.

COMPARATIVELY SIMPLE drawings only have been discussed thus far in these articles. One set of drawings represented only a two stage volume control amplifier without internal power supply; another, an amplifier that did have its own built-in power circuits, but it was only a one-stage amplifier.

Figure 1 of this article is the wiring diagram of a representative type of system amplifier—the apparatus is illustrated pictorially in Figure 2. It is neither an exceptionally difficult nor an exceptionally easy unit to diagram.

The chassis of Figure 2 slides forward and then can be tipped to make the wiring underneath accessible. The largest drawing in Figure 1 represents the apparatus as seen with the chassis turned upside down. Thus the fuse, which in Figure 2 is seen at the lower right-hand corner (just in front of the glass tube) appears in Figure 1 as FS-1, upper right hand corner; and the glass tube is represented as VS (vacuum tube socket)-5. The jack for the monitor speaker connection, J-1, is seen in Figure 2 just to the left of the fuse; in Figure 1 it is also located left of the fuse, and it appears a second time (without connecting wires) in the small drawing at the top of Figure 1.

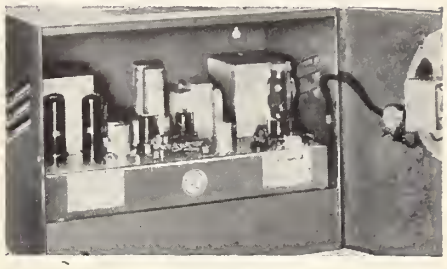
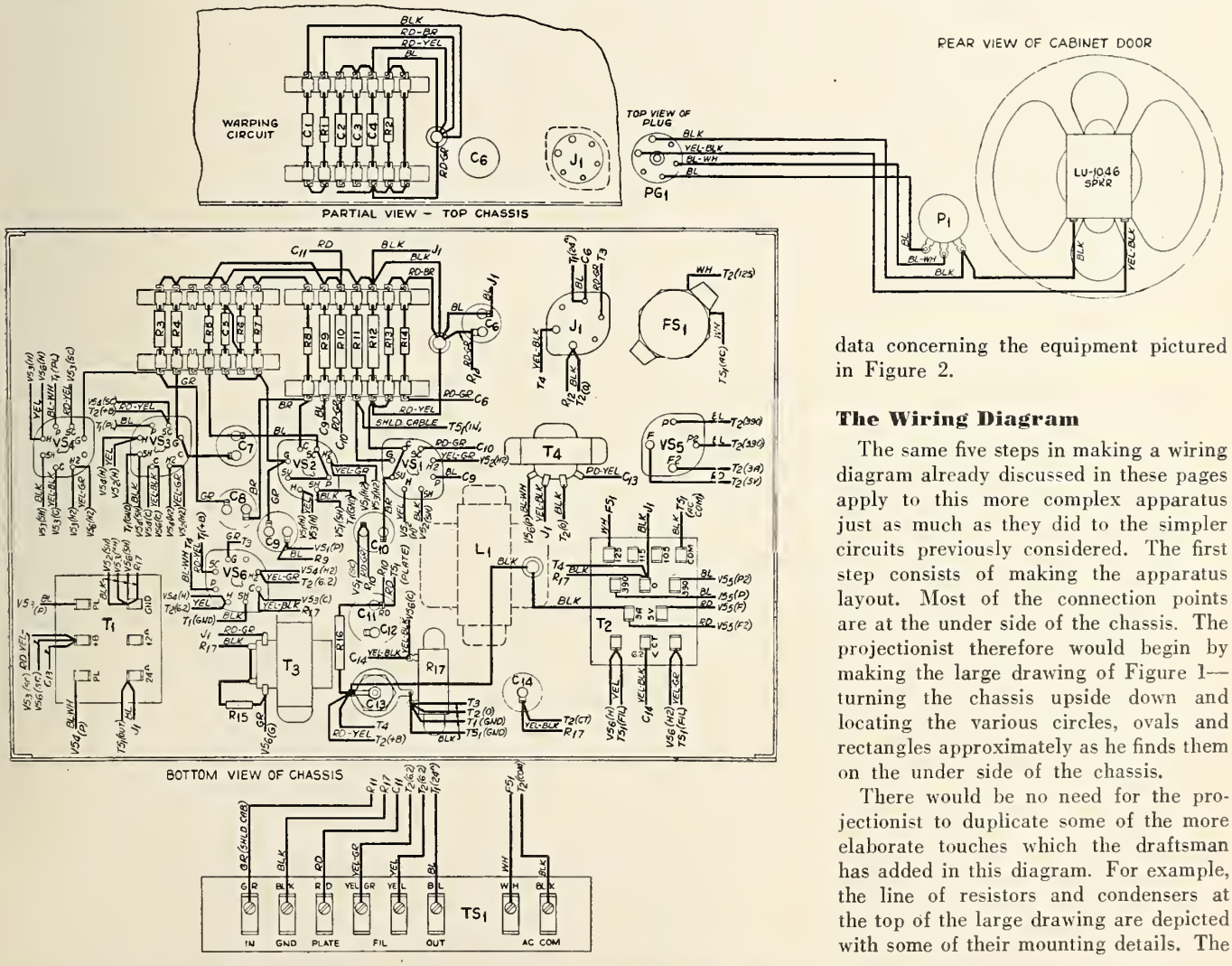


FIGURE 2

Note that the wiring diagram, Figure 1, requires four separate drawings and a tabulation to convey all the necessary data concerning the equipment pictured in Figure 2.

† "How to Make Your Own Schematic Diagrams.—Preliminary Steps," *Inter. Proj., Aug.* 1944.

FIGURE 1



The Wiring Diagram

The same five steps in making a wiring diagram already discussed in these pages apply to this more complex apparatus just as much as they did to the simpler circuits previously considered. The first step consists of making the apparatus layout. Most of the connection points are at the under side of the chassis. The projectionist therefore would begin by making the large drawing of Figure 1—turning the chassis upside down and locating the various circles, ovals and rectangles approximately as he finds them on the under side of the chassis.

There would be no need for the projectionist to duplicate some of the more elaborate touches which the draftsman has added in this diagram. For example, the line of resistors and condensers at the top of the large drawing are depicted with some of their mounting details. The

projectionist can afford to be satisfied with a simple row of rectangles. Similarly, L-1 and T-3, near the center and bottom left of the drawing, are almost pictorially represented. Rectangles or squares carrying the identification numbers will serve practically as well. Also FS-1, top right of drawing, can be shown as a simple circle; the circle inside an octagon, and the little extensions representing mounting brackets, are refinements that may be left to professional draftsmen who have the equipment and training for adding such matters.

It is desirable, however, to imitate the draftsman in one detail—L-1 is drawn with a dotted line, and there is a little circle toward the right of that part which is entered by two wires. The dotted line means that there is no connection to L-1 at the bottom of the chassis, but that the wires run up through the circle to connection points above the chassis.

When the large drawing of Figure 1 has been completed so far as concerns parts layout, the projectionist will note that there are still parts and connections of Figure 2 which have not been included. Therefore, he must make separate drawings to show as much as is necessary at the top of the chassis, of the terminal strip, and the cabinet door.

The second step in making Figure 1, it will be remembered, is that of adding terminal points to tube sockets, transformers and other items of apparatus.

The third step, adding equipment information, will consist partly of writing identifying numbers and other details on the drawings, and partly of making the tabulation, as shown in Table A. The identifying numbers are those in the left hand column, headed "Desig." (designations). The parts numbers, in the second column, are the *amplifier* manufacturer's

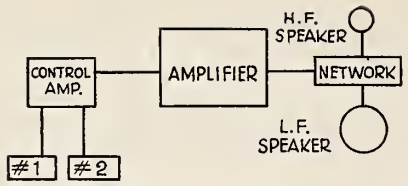


FIGURE 4-a, *above.*

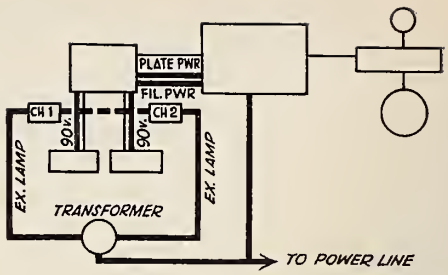


FIGURE 4-b, *right.*

part numbers. Whenever these are stenciled on the apparatus they should by all means be tabulated. If they are not so stenciled, the manufacturer's instruction book may list them, and thus make tabulation possible. If there are no such numbers, then the second column of the tabulation of Figure 1 must of course be omitted. The *parts* manufacturer's numbers, if available, belong in the right-hand column of the tabulation.

Note that in the case of condensers this tabulation lists voltage as well as capacitance; in the case of resistors it lists both ohmage and wattage—and further, when the resistor is of wire wound type the tabulation says so.

The fourth step, which also has been discussed in detail in past issues of I. P., is that of adding short stubs of wire to each terminal post of Figure 1; and the fifth step, writing in the wire information —that is, which part and what terminal of that part the wire goes to, and the color of the wire if it is color-coded. It is desirable to keep steps 4 and 5 separate, to avoid confusion and possible mistakes; putting in all the wire stubs first and then going back over the drawing to trace the wires one by one and write in the necessary data.

The Schematic Diagram

Figure 3 is the schematic drawing made from Figure 1. Note again how comparatively simple the schematic is—how much more easily electrical trouble can be traced in the schematic than in the wiring diagram.

The customary arrangement of parts is followed in this schematic; the power transformer, rectifier tube and filter choke are at the bottom right. Sound input is at the left of the drawing, sound output at the right. The amplifier tubes are arranged in a line across the top, except that the push-pull tubes are placed one above the other—which is practically an invariable custom. The monitor amplifier tube, together with the monitor speaker, are off to one side of the drawing, which also is the usual way of locating those components.

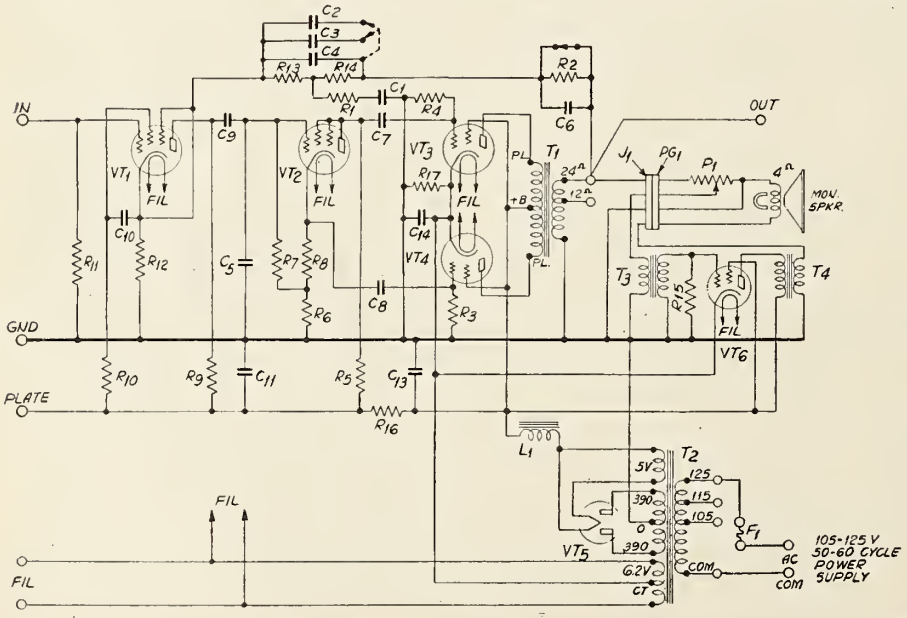
Some draftsmen would represent one feature of this circuit a little differently than in Figure 3. The second tube in the top line, VT-2, does not represent another stage of amplification—it is a phase inverter tube. The projectionist, tracing his wiring drawing, will have little trouble deciding a fact of that kind. If there is a push-pull stage, but no input transformer to the push-pull stage, then some tube (or part of a tube) must function as a phase inverter. In the present circuit, VT-1 grid goes directly to input; VT-3 and VT-4 plates go to the output transformers; VT-5 is a power supply rectifier; VT-6 plate goes to the monitor speaker transformer. There must be a phase inversion stage, however, and VT-2 is the only tube that can be the inverter. That VT-2 is in fact the inverter is shown by the connection of its plate (through condenser coupling) to the grid of one of the push-pull tubes—the grid of the other push-pull tube being supplied by VT-1.

The inverse feedback circuit (with its "warping" arrangements for frequency control) is shown at the top of Figure 3, above the tube lineup, as is the custom.

Making Figure 3 involves, as the first step, properly laying out these major parts on paper; the tubes, transformers, monitor speaker, and so on, being located according to their electric functions. The minor parts—resistors, condensers, jack, fuse, and what-not are then added in their appropriate locations, so far as they can be without tracing the connections of Figure 1 in detail.

It was said in an earlier discussion of this subject that steps three and four of making a schematic drawing consist, respectively, of drawing in the wires and then adding the appropriate wire infor-

FIGURE 3



mation and parts information. However, in the case of Figure 3, here shown, there is no wire information on the drawing, and the parts information consists exclusively of identification numbers. Therefore, in the case of this schematic, step four is scrambled with steps one and two —the identification numbers being added at the time the parts are drawn in. Step three (drawing in the wire connections) constitutes the last step.

Re-drawing Schematics

In the case of a schematic as complex as that of Figure 3—and there are many items of theatre apparatus even more intricate—the first drawing made from the wiring diagram may not be the last possible word in simplicity and clarity. Even a man quite experienced in such work may find, when he looks over his finished schematic, that by shifting the positions of some minor parts symbols, and re-arranging some of the connecting lines, a better drawing could be obtained.

Hence it is sometimes a good idea (if too much time has not already been consumed) to draw a second and final schematic, not from the wiring diagram, but from the first schematic. For example, in Figure 3, L-1 is placed horizontally; but suppose the lower filament leg of VT-5 had been carried a little further to left and L-1 had been drawn vertically in series with one straight vertical line. Again, if the secondary winding of T-1 had been made longer the screen speaker output from the top of that secondary might have been run straight right instead of upward and right, as shown.

TABLE A

DESIG	PART No	APPARATUS
C1	5N-515	CAPACITOR - .005 MF - 500V
C2	" 582	" .001 " - " "
C3	" 581	" .00075 " - " "
C4	" 512	" .0005 " - " "
C5	" 516	" .0003 " - " "
C6,7,8,9,10	" 514	" .05 " - 400V
C11,C12	" 507	" C11 $\frac{25}{330}$; C12 $\frac{25}{330}$
C13	" 508	" 4 MF 600 V
C14	" 502	" 25 " 50 "
R1	5N-572	RESISTOR - 500 Ω - 1/2 WATT
R2	" 1071	" 100,000Ω - " "
R3,R4,R9	" 580	" 250,000Ω - 1 "
R5,R7	" 526	" 30,000Ω - 1/2 "
R6,R15	" 540	" 25,000Ω - 1/2 "
R8	" 531	" 5,000Ω - 1/2 "
R10	5N 517	RESISTOR - 2 MEG. - 1 WATT
R11	" 518	" 500,000Ω - 1 WATT
R12	" 1130	" 2,000Ω - " " WIRE W
R13,R14	" 528	" 7,500Ω - 1/2 "
R16	" 1111	" 15,000Ω - 2 "
R17	" 535	" 250Ω - 5½" WIRE W
TS1	AM-2072	TERMINAL STRIP ASSEMBLY
J1	5N-564	STANDARD 6 PRONG SOCKET
P1	" 1120	POTENTIOMETER - 2000Ω
PG1	" 560	STANDARD 6 PRONG PLUG
T1	" 575	OUTPUT TRANSFORMER
T2	" 1076	POWER TRANSFORMER
T3	" 1107	INPUT TRANSFORMER
T4	" 1106	OUTPUT TRANSFORMER
L1	" 1073	REACTOR
V51,2,3,4,6	" 561	OCTAL SOCKET
V55	5N-562	STANDARD 4 PRONG SOCKET
F51	" -554	FUSE RECEPTACLE
*VT1-VT2	" 1066	VACUUM TUBE TYPE 6SJ7
*VT3-VT4	" 1109	VACUUM TUBE TYPE 6L6
*VT5	" 708	VACUUM TUBE TYPE 523
*VT6	" 1075	VACUUM TUBE TYPE 6F6
F1	" 549	FUSETRON (2-AMP)

These would be very minor improvements in Figure 3—in fact, it is practically impossible to find any way in which Figure 3 could be improved materially. But when the projectionist unskilled at such work finishes *his first* schematic, chances are there will be many ways in which it can be improved, and drastically so. Of course, such improvements will have nothing to do with its accuracy—they will merely make the same drawing easier to read and trace. However, since clarity is (after accuracy) the principal virtue of a schematic, re-drawing is not uncommon, even in the case of professional draftsmen.

System Drawings

Two types of *system* drawings are used, corresponding to schematic and wiring diagrams. The schematic is commonly called a block schematic. The wiring diagram is also known as system diagram, conduit diagram, or installation diagram.

The system schematic, or block schematic, will give the projectionist no trouble. In fact, he does not need it for his own use, and if he makes one at all he will do so only for the guidance of relief men. Figure 4-A is a block schematic of the sound system which includes Figure 3.

Only sound connections are shown in Figure 4-A—power linkages are omitted. Note that in this drawing a single line is used to represent a *pair* of wires. That is customary in such drawings.

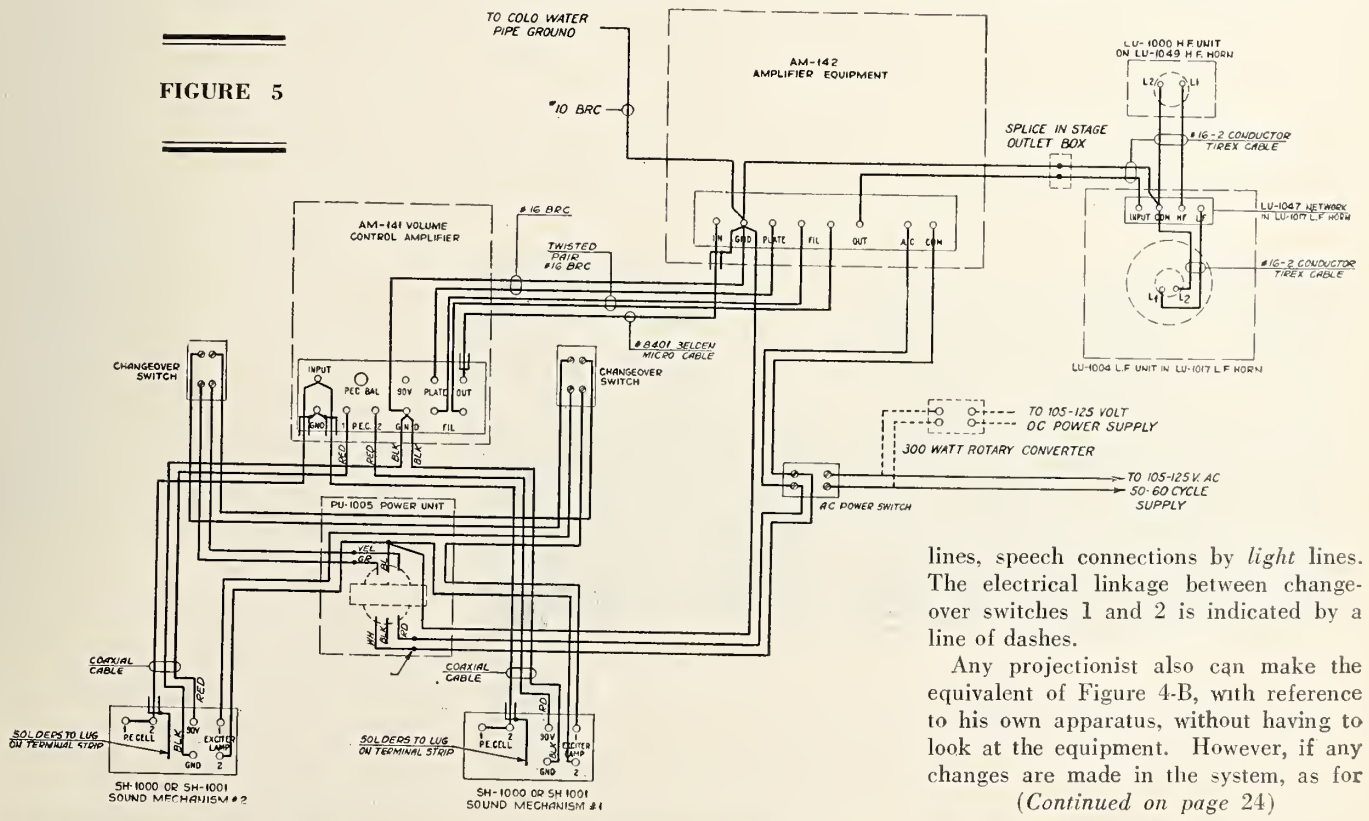
Any projectionist can make the equivalent of Figure 4-A for the equipment in his own projection room without having to look at the apparatus.

Figure 4-B is a duplication of Figure 4-A, with the power wiring added. In the case of the power wiring also, a single line is used to represent a pair of wires. Power connections are indicated by *heavy* lines, speech connections by *light* lines. The electrical linkage between changeover switches 1 and 2 is indicated by a line of dashes.

Any projectionist also can make the equivalent of Figure 4-B, with reference to his own apparatus, without having to look at the equipment. However, if any changes are made in the system, as for

(*Continued on page* 24)

FIGURE 5



IN THE SPOTLIGHT



By *HARRY SHERMAN*

ALTHOUGH all I. A. local unions throughout the country have assured their members serving with the armed forces that their jobs would be waiting for them immediately upon returning to civilian status, Arthur Martens, president, and Richard (Dick) Hayes, business agent, respectively, of Westchester County Local No. 650, went a step further and devised a plan that is proving beneficial to members in service as well as to the members at home.

In each instance, when a man is called to military service another member of Local 650, generally a man working in a low-scale theatre, is permitted to cover his job for one month only. Twelve temporary jobs for twelve members are thus created, with each one of the men being given an opportunity to work for one month at a higher scale than his own job pays. The most important feature of this plan, however, lies in the fact that the man in service receives the full benefit of the two-weeks' vacation pay. The vacation money is sent direct to the union offices and there either Martens or Hayes forwards it to the projectionist in service, regardless of where he may be stationed. Checks have been mailed to Local 650 members serving in Saipan, France, England and the Philippines.

A splendid idea, we think, and one that should be adopted by other local unions.

● We are happy to report that Dick Green, former I. A. secretary-treasurer, is now recuperating at home from a serious operation. Dick has the best wishes of his many friends throughout the country for a speedy recovery.

● At long last Tom Canavan, Altec chief in St. Louis and brother of former I. A. prexy, Wm. F. Canavan, forsook the joys (?) of single-blessedness and joined the ranks of benedicts. Tom was married to Miss Ault, also of St. Louis. Good luck and best wishes to you both.

● Our good friend Abe Kessler keeps right on rollin' along. He was recently elected president of the Projectionists' Square Club. The 25-30 Club, of which Abe is a charter member, presented him with a gavel at the installation of officers. Other elected officers were Joe Harrison, vice-president; Harry Storin, secretary, and Cpl. Izzy Schwartz, treasurer. All are members of Local No. 306, New York City.

● The Famous Players Canadian Circuit tendered a dinner party to a group of projectionists in its employ for the past 25 years. As a token of appreciation for faithful service the Circuit presented to each member of this group a choice of either a gold watch or a $100 War Bond, in addition to a certificate of membership in its newly organized 25-Year Club.

Among the projectionists honored at this dinner were Charles Dentelbeck, projection supervisor for Famous Players; Harry Peer; William More; Harold C. Edwards; Sam Haigh; Fred Baldassari; Gus R. Demery; Ray Hansom; Jim Sturgess; J. H. (Hank) Leslie; Wm. Holden; Wm. Rossborough; George Robinson; Tom Marsden; Jim Bailey and Arthur Barber.

● We were recently visited by Elmer Olson, business agent of Local No. 744, Cadillac, Michigan. Olson told us that he stopped off at the headquarters of Local No. 199, Detroit, Michigan, and promised the boys he would convey to us their regards. Thanks, boys.

● Speaking of Local 199, Frank Kinsora, its president, was elected to head the Michigan State Alliance at the recent annual meeting. Frank's cigars are his trademark—the bigger and blacker they are the better he likes them. We'll take vanilla.

● Herbert Silberberg, member of New York Local No. 306, advises us that his son, Lt. William C. Silberberg, was awarded the Oak Leaf Cluster and promoted to a first lieutenancy on the battlefield. Lt. Silberberg was twice wounded in combat and is now back in action again. You can't keep a good man down.

● C. Richard (Dick) Silver, secretary-treasurer of Hollywood Local No. 165 is back at his desk after an absence of two weeks occasioned by an attack of the flu.

● George Edwards, former president of the American Projection Society and one of the oldest members of Local No. 306, has been seriously ill for the past few years and will not be able to work again. Friends and associates who know of the splendid work Edwards has done for the craft and for the entire motion picture industry are sponsoring a testimonial to



Eugene J. Atkinson, business manager of Local No. 110, Chicago, and his staff of officers congratulate Sam Mansfield, member of Local No. 110, upon his installation as Master of Medinah Masonic Lodge.

Left to right: Edward H. Schulze, trustee; Arthur Tuchman, member of executive board; Frank Galluzzo, vice-president; Sam Mansfield; James J. Gorman, president; Sam Klugman, member of executive board; Eugene J. Atkinson, business manager, Charles Funk, member of executive board, and Clarence A. Jalas, assistant business manager.

be given him. The Committee in charge of all arrangements is headed by Ben Norton, president of the A. P. S.; Tony Rugino, treasurer, and P. A. McGuire.

George Edwards has many friends throughout the United States and Canada, most of whom, we are sure, will be glad to take part in this testimonial. For further information regarding the arrangements write to Tony Rugino, 3000 Valentine Ave., Bronx 58, N. Y.

● The hopes of the Christian-American Association, notorious labor haters of Texas, were squelched by a five to four decision by the United States Supreme Court which held that the registration and licensing of labor organizers was unconstitutional.

"*A requirement of registration in order to make a public speech would seem generally incompatible with an exercise of the rights of free speech and assembly*," said Justice Wiley Rutledge, who wrote the majority opinion. This is the answer of the Supreme Court to the Texas Anti-Labor law, and it probably will invalidate several other state anti-labor laws sponsored by the Christian-American Association. However, despite the decision of the highest court in the country, this organization is still determined to continue with its anti-union drives in many states. Keep your eyes on these babies and don't fall for any of their insidious and vicious anti-labor propaganda.

● We regret to report the death of Joseph P. Kramer, one of the old-time members of Chicago Local No. 110. Our condolences to his family.

● Timothy Sean O'Brien—the latest addition to the O'Brien clan. We refer, of course, to our very good friend, Morton D. O'Brien, charter member of Local No. 640, Long Island, N. Y., and assistant director of projection and sound for Loew's, Inc. The appearance of young Timothy, son of Captain O'Brien, Jr., of the U. S. Marine Corps, now puts "Obie" in the grandfather class with yours truly and many other old-timers.



M. D. O'Brien

M. D. O'Brien, or "Obie," as he is best known in the industry, is a veteran of World War I, having served as chief electrician in the U. S. Navy from 1917 to 1918. He was an instructor at the U. S. Navy Motion Picture Operators School in the Brooklyn Navy Yard from 1922 to 1924. He has held the post of assistant director of projection for Loew's for almost two decades, and has gained an enviable reputation in this field for his expert supervision of the installation of sound and visual equipment in many theatres throughout the country. We salute M. D. O'Brien—a credit to our craft.

● One of our Canadian readers, N. Tanner, member of Local No. 173, Toronto, Ont., Canada, paid a visit to the offices of I. P. the other week and we had quite a time discussing our many mutual friends. Tanner has very definite ideas on unionism and we were very much interested in his intelligent setting forth of his ideas. We look forward to a resumption of our discussions when we make our contemplated trip to Toronto early this spring.

● Congratulations and best wishes to our friend, Houston S. Morton, member of Local No. 199, Detroit, Michigan, and Chairman of the Television Committee, on his new business venture—United Equipment Company. The opening, which was held the early part of this month, was attended by Morton's many friends from all parts of the state and by a number of leading manufacturers of theatre equipment.

● The following interesting letter received from Local No. 348, Vancouver, B. C., Canada, speaks for itself and we publish it here for the benefit of other local unions who may be planning similar classes:

Dear Brother Sherman:

Some time ago the Television Committee for Local No. 348, was instructed to seek information on television and to find out what other local unions were doing about the subject. We had the pleasure at that time of writing to you for such information as you could give us and your reply was very helpful in setting us in the right direction. This letter will inform you as to what we have accomplished in the formation of classes for the study of radio and television.

With the cooperation of the Extension Department of the University of British Columbia the Television Committee was successful in organizing classes which are held every Sunday morning in the Science building at the University. These sessions last two hours and are very ably conducted by one of the University's instructors on Electricity and Radio. Incidentally, he also instructed the armed forces stationed here on Radar and Electronics.

The present term began November 26,

(*Continued on page 23*)



State of New York

Department of State

Albany

IT IS HEREBY CERTIFIED THAT THE CERTIFICATE OF INCORPORATION OF

"25—30 Club, Inc."

was filed in this Department this thirteenth day of December, 1944

Witness my hand and the official seal of the Department of State at the City of Albany this 15th day of December, 1944

Facsimile of 25-30 Club charter.

25-30 Club Notes

SANS opposition, all officers of the 25-30 Club were re-elected unanimously for the new 1945 term. In accordance with the times, the installation ceremonies were brief—a fact greatly appreciated by the members present who were eagerly looking forward to the showing of motion pictures by the guest of the evening, Francis Doublier.



Mike Berkowitz, Pres. 25-30 Club

Doublier is said to be the first newsreel cameraman in this country and his first assignment was the filming of the coronation of Czar Nicholas II in May, 1896. His presentation at the meeting consisted of a number of old subjects which he filmed himself many years ago and which were enthusiastically received by the members. In recognition of his pioneering in this field and of his many contributions to the art, Doublier was made an honorary member of the Club.

The re-elected officers of the Club are Mike Berkowitz, *pres.;* Morris J. Rotker, *vice-pres.;* Morris I. Klapholz, *rec.-sec.;* Henry Weinberger, *treas.;* Joe Abrams, Bob Sanders and Joe Fitterman, *trustees.*

The meeting closed with the usual refreshments and it was 4 A.M. when a band of weary but convivial old-timers wended their way homeward.

• • •

A good deal of the credit for obtaining the Club charter belongs to vice-president Morris J. Rotker. Rotker put in many days of hard work in getting the necessary machinery in motion and his efforts were finally rewarded with the granting of the charter, a copy of which appears elsewhere on this page.

The charter now hangs in the offices of I. P. and will remain there until permanent club rooms are found.

Projectionists' Course on Basic Radio and Television

By *M. BERINSKY, E. E.*
MEMBER OF INSTITUTE OF RADIO ENGINEERS

VIII — DIRECT CURRENT METERS

ONE of the most important applications of electromagnetism is found in the direct current meter. These meters are found in many different forms and have varied applications. We are familiar with voltmeters, ammeters, ohmmeters, and wattmeters, yet these are a relatively new invention.

During the last quarter of the 19th century it became apparent that the use of electrical energy in industry and the home was destined to become an outstanding development. At that time motors and generators as a means of supplying power and light, were beginning to attract attention. In order to improve the design of these machines a means for making electrical measurements quickly and accurately was found to be necessary, since without dependable commercial testing instruments, development work of a research or engineering character was greatly retarded.

Electrical measuring instruments of that period were cumbersome and crude. Although a host of early scientists had devised various forms and types of instruments, none of the devices were reasonably accurate, quick reading or really serviceable.

Among the scientists who were interested in electrical instruments in the early days of practical electricity were Marcel Deprez and Prof. A. D'Arsonval in France; Kelvin, Ayrton, Perry, Cardew in England; Siemens, Kohlrausch, Hummel, and others in Germany. None, however, had solved the problem or even approximated that goal, although many so-called electrical measuring instruments were made and used.

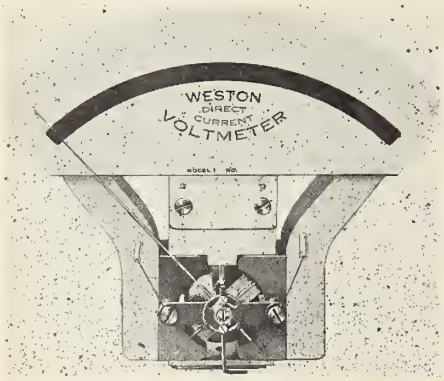


FIGURE 1. *Completely assembled meter.*

At that time an American scientist, Dr. Edward Weston, was engaged in the manufacture of electric dynamos. His work was greatly hampered and made vastly more laborious and burdensome by reason of a want of satisfactory measuring instruments. Hence, he became impelled to devote his prime attention to the study of the practical requirements of his own measuring needs and those of the electrical industry at large. This self-imposed task occupied several years of investigation, led into many fields of research, and became so diversified in character as to embrace physical, chemical, mechanical, and electrical phases.

Development of Weston Meter

The result of these experiments was the Weston moving coil meter. This instrument was superior to anything that had previously been available. This meter had the advantage that it was portable and light in weight, highly accurate, could be manufactured at a low cost, and, when carefully used, would retain its accuracy over long periods of time. Practically all electrical energy of that period was generated and supplied in the form of direct current.

It was natural, therefore, that the first instrument manufactured under the auspices of Dr. Weston was the type previously mentioned. The meter has not changed materially since those early days. When it was first placed on the market there was considerable skepticism about the possibility of making a magnet permanent. Time demonstrated that this skepticism was unfounded and these new instruments soon became recognized and adopted by engineers, by physicists, and by experienced experimenters.

In addition to the moving coil direct current meter Dr. Weston developed a high grade movable iron vane type of meter which could be used on direct or alternating current circuits where extreme accuracy was not required. This type of meter is used at the present time to check the voltage of storage batteries.

Figure 1 shows the assembled internal construction of a direct current permanent magnet, pivoted, movable coil type of instrument. We shall dissect it so that its parts may be considered in detail.

You will note that the most prominent visible parts depicted in Figure 1 are a magnet and a movable coil. The magnet has a horseshoe shape; part of it is drilled and tapped and provides a convenient means for mounting the scale. The portion of the magnet near to the coil has fastened to it two soft iron pole pieces. These are necessary in order to provide a strong magnetic field with very little leakage flux in the vicinity of the moving coil.

The magnet itself is of hard iron or steel because it must retain its magnetism over long periods of time. The movable coil is made of several turns of wire carefully insulated and wound upon a rectangular aluminum frame. This coil is pivoted in sapphire bearings and arranged so that a current may flow through its windings. By virtue of its mounting, rotary motion only is possible. This motion is opposed by means of two springs, which also serve as conductors to carry the current into and from the movable coil winding. These springs cannot be seen in Figure 1, but Figure 2 shows them clearly.

It should be remembered that this movable coil, although containing no iron, has all the properties of a magnet when a current is sent through it; and, therefore, it will have polarity, Since it lies in an intense magnetic field it will tend to move, due to the action between the electro magnetic field created

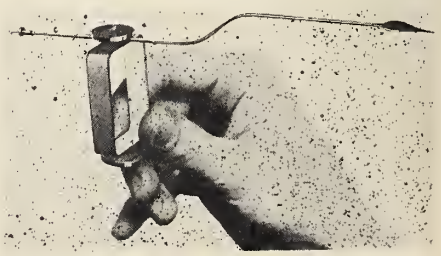


FIGURE 2. *Moving coil and springs.*

by the current carried in the winding of the coil and the magnetic field of the permanent magnet causing these two magnetic fields to establish a certain relation of their respective lines of magnetic force. Hence, when current is sent through the movable coil which also carries a permanently affixed pointer (see Figure 2) a deflection will be obtained corresponding to the strength of that current.

Since the number of turns on the coil are fixed the only way of changing the ampere turns is to increase the current through the coil. This will increase the strength of the magnetic field of the coil. The field of the permanent magnet is mounted so that it opposes the field of the coil and the coil will therefore be repelled, since it is mounted so as to be free to move in its bearings. When the current through the coil is increased the force of repulsion between coil and magnet is also increased and a greater amount of needle deflection is obtained. The pointer moves over a precisely calibrated scale and indicates the value of the current being measured.

A meter of this type has polarity and its terminals are marked positive and negative. If the meter were accidently connected in the reverse polarity the direction of the flux through the coil would be reversed and the direction of needle deflection would be toward the left instead of toward the right as is the normal case.

Field Pattern of Magnet

We will now consider the permanent magnet's field pattern. Suppose that a piece of paper were held over the permanent magnet of a Weston meter and some iron filings were sprinkled over the paper. The field pattern shown in Figure 3 would result. As you can see, the iron filings will line up in the direction of the lines of force and the effects of these lines are made visible in every direction.

Only those passing directly between the poles are of service in the operation of the instrument. Notice the heavy concentration of flux at the poles. These useful lines of force that form the field in the space where the movable coil rotates normally consist of nearly straight lines between the poles of the magnet moving out of the north pole and into the south pole. The shape of the field in Figure 3 would not serve our purpose.

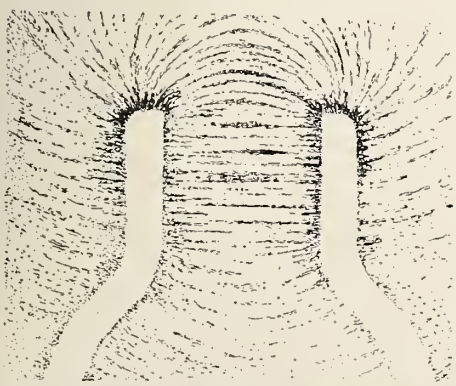


FIGURE 3. *Magnetic field around a meter magnet.*



FIGURE 4. *Same magnet as shown in Fig. 3, but with soft iron pole pieces.*

The next step in the construction of the magnetic system is the addition of soft iron pole pieces attached to the ends of the magnet (Figure 4). The addition of these pole pieces has the effect of concentrating the magnetic lines that we wish to use, and they form a ring on the faces of the pole pieces. There are some lines in the center which are still parallel and have not yet taken a uniformly radial position such as is desired. The radial position of these lines is the ideal that is desired since it gives a concentrated and uniform field throughout the path of rotation of the moving coil. To obtain this uniform or radial field a cylindrical core of soft iron is inserted.

In Figure 5 it can be seen that we now have obtained a uniform radial field. To permit freedom of rotation of the movable coil within this radial field the air gap between the core and the pole pieces must be accurately established. This is made possible through precise manufacturing operations. The air gap, for an average instrument, is made 0.05 inch in width, that is, the annular space between the pole piece and core through which the moving coil travels is 0.05 inch wide.

Since there is practically a uniform magnetic field established in the air gap through which this carefully wound coil rotates it follows that the deflection of the coil and pointer will be correspondingly proportional to the current in the coil and the instrument will have a uniformly divided scale. That is, the divisions on the scale representing increase in current strength will be evenly spaced as far as the eye can discern.

Another point of importance regarding this magnet is the methods used to assure its permanency. It is well known that a magnet which is supplied with a keeper or piece of soft iron will retain its magnetism longer than one with no keeper, and when this keeper is properly designed the magnetism will be retained unimpaired almost indefinitely, as it provides a path of low reluctance for the lines of force. You will recall that the distance between the pole piece and core were each made very minute and that the pole piece and core were each made of soft iron, so you readily can see what actually was accomplished was, in effect, to provide the magnet with a keeper. In other words, the air gap is so small that it does not disrupt or impede the path of the lines of force to any appreciable extent and enables the magnet to retain its permanency throughout an indefinite period of years.

The Movable Coil

The movable coil, which might be called the heart of the movable system. is made up of several turns of wire carefully insulated and usually wound upon an aluminum bobbin or frame. Its parts are so designed and constructed that their weight is reduced to the minimum consistent with requisite mechanical strength. This is very important since excessive weight in the movable system causes pivot friction and a rapid wearing out of the pivots and also makes the coil

JANUARY QUESTIONS AND CORRECT ANSWERS

1. (Q.) Why does a coil make a stronger magnet than a straight wire?
(A.) The flux around each turn in the coil adds to give a strong field.

2. (Q.) Calculate the number of Gilberts in a coil of 1,000 turns carrying one ampere.
(A.) 1,260 Gilberts.

3. (Q.) Name three uses for electromagnets.
(A.) Lifting magnets, speaker fields, magnetic brakes, relays, etc.

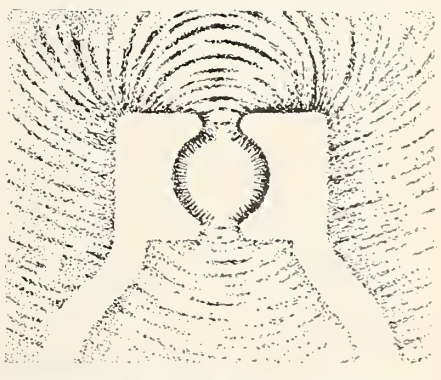


FIGURE 5. *Same magnet as shown in Fig. 4, but with soft iron core (keeper) added.*

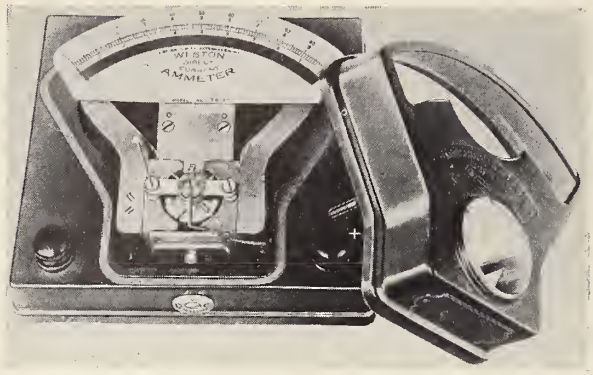


FIGURE 6.

Complete instrument with cover removed.

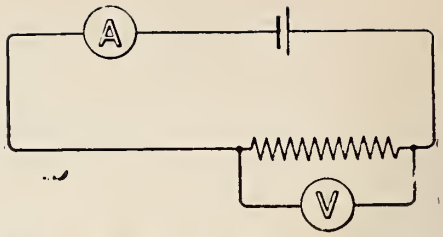


FIGURE 9. ***Proper connections for voltmeter and ammeter.***

less responsive to small changes in current.

The movable coil shown in Figure 2 is taken from a switchboard voltmeter, its dimensions are roughly 1 x 1⅜ inches. The size of the many moving coils found in practice depends upon the type of instrument in which they may be used. In miniature precision instruments the movable system weighs less than 0.2 gram, although consisting of about sixteen parts. Some of these parts are so small that they must be examined under a magnifying lens in order to learn their exact form. Their mass must be distributed with such care and exactitude that the center of gravity of the complete movable system is almost exactly aligned with the pivots. This alignment is finally perfected by means of minute nuts on the cross arms and tail piece of the pointer.

Meter Damping

Another point in reference to the action of the moving coil is the manner in which it is "damped," that is, the way in which its motion is slowed down to prevent excessive overswing and oscillation before settling to rest at its final position.

You will recall that the coil is wound on an aluminum frame. Thus, when it rotates through the magnetic field of the magnet it cuts the lines of force. One of the laws of electricity which we have not yet studied is that of induced currents. When a conductor cuts a magnetic field a current is induced in it. These currents are known as eddy currents. When eddy currents occur they set up a force that tends to oppose the force that is causing them. This is known as Lenz's Law.

The force causing the eddy currents in a moving coil is the movement of the coil. The opposing force will tend to act against the movement of the coil. This opposing force then tends to slow down the movement of the coil, causing it to come to rest quickly. Commercial meters usually are well damped and come to rest quickly during the course of making measurements. Figure 6 shows the complete instrument with protective cover removed.

Voltmeters and ammeters are practically alike and the same instrument may be used for both purposes. The voltmeter has a large resistance connected in series with it to prevent the meter coil from taking too large a current and thereby burning out, when the meter is used to measure high voltages. This coil, called a multiplier, is mounted inside of the meter case. This is the only difference between a voltmeter and an ammeter.

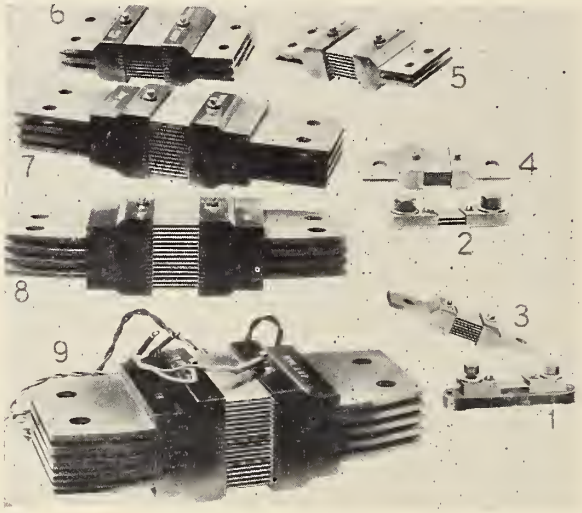


FIGURE 8.

Commercial meter shunts.

A voltmeter may have several multipliers connected in series to increase the range of the instrument. These can usually be selected by a switching arrangement. The voltmeter will then have several scales such as 0-10, 0-100, 0-250, 0-500, and 0-1000 volts.

The range of an ammeter can be increased by the use of shunts. These shunts are shown in Figures 7 and 8. They are connected in parallel with the meter. They drain away all except the original ammeter current and the amount which is drained away plus the amount going into the meter is the current being measured. The ammeter scale is appropriately calibrated and has several current ranges. These may be selected by a selector switch on the front panel. In radio work the ampere is too large a unit so one-thousandth of an ampere, the milliamp, is used. Common current ranges are 0-1, 0-10, 0-100, and 0-1000 mils.

Radio testers are designed for maximum economy, therefore, one meter will measure current, voltage, and ohms. Selector switches are provided to enable the operator to choose the proper scale. Ohms are read by connecting a battery in series with the meter and the unknown resistor and measuring the resulting current, but instead of calibrating the scale in amperes it is calibrated in ohms since the resistance is inversely proportional to the current. The battery is usually mounted in the meter box.

Voltmeters are always connected across the terminals of the device which contains voltage. Ammeters are always connected in series with the device which draws current and the line. Figure 9 shows the proper connection of a voltmeter and an ammeter.



FIGURE 7. ***Ammeters with shunts connected.***

FEBRUARY QUESTIONS

1. Why are soft iron pole pieces used in a meter?

2. Why is a core used?

3. Why are jeweled pivots used?

4. Why is the moving coil wound on an aluminum frame?

The correct answers to these questions will appear in the next issue.

AT YOUR SERVICE

This department is a collection of random thoughts and some not so random: fact, fancy and opinion relating to the man behind the man behind the gun—the serviceman. The prime purpose of this section is to promote a closer relationship between serviceman and projectionist based on a better understanding of their mutual problems through an exchange of news and views, kinks and kicks. To this end, contributions relative to any phase of the serviceman's activities are invited.

Eliminating "Wows"

At one of my theatres I made several trips to eliminate a "wow" condition which was apparent on sustained runs of music, such as violin or piano. The soundheads were checked and rechecked, new rollers, pressure rollers and cleaning of the stabilizer shafts and bearings as well as flushing of the soundheads had no effect on the condition which would come and go.

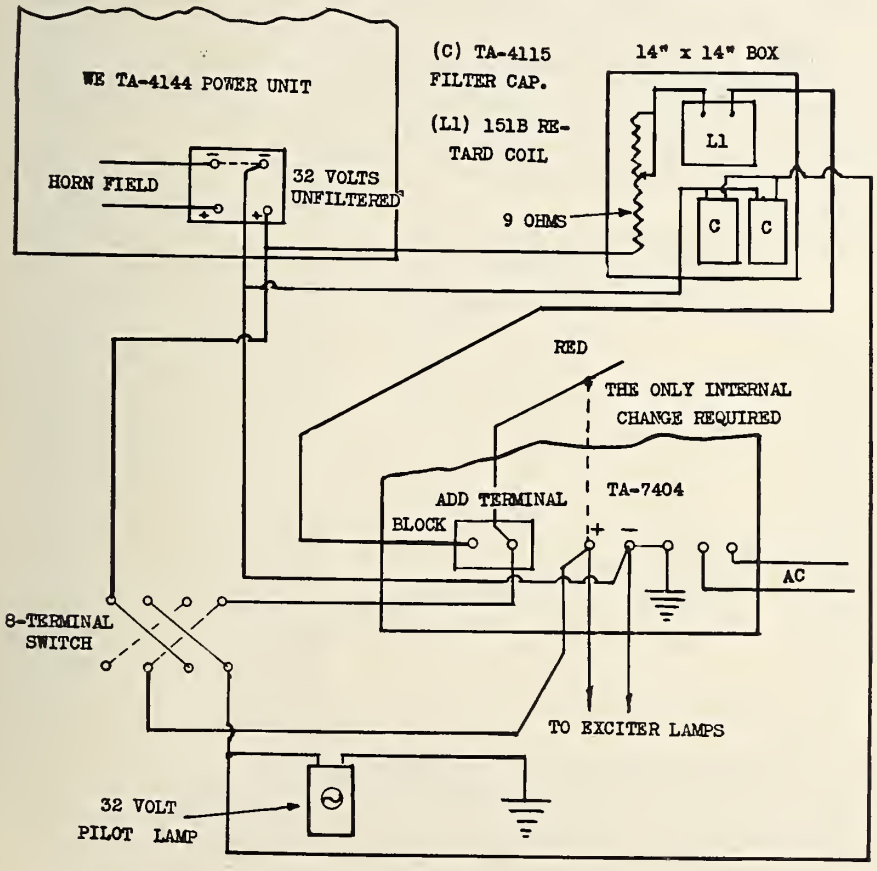
After trying all of the known methods to eliminate this condition, I finally dismantled everything in the soundhead gear box. When nothing remained but the worn gear and bearings, I discovered that the front bearings would bind about every tenth revolution. When the bearing was washed in kerosene, it bound about every fifth revolution. It was apparent that some foreign particles had worked their way into the bearings. Washing all of the soundhead parts in kerosene and replacing the bearing corrected this condition. In this particular case, it was not a bind but a drag that caused rough movements of the head and brought about this particular trouble.—Monroe Levy, *RCA*.

Emergency Exciter Lamp Operation on a WE-6A86 System

I recently used an emergency hook-up on a WE-6A86 system which has proven very satisfactory and works so well that I would like to pass this information on to the other engineers in the field.

In the event of failure of the TA-7404 exciter lamp supply, the TA-4144 horn field supply power unit is used to supply exciter lamp current. The main features are that a single switch can be used to operate the emergency connections during operation of the show with scarcely a flicker of the exciter lamp or a change in sound level.

The filtering is excellent even though the unfiltered portion of the 32 volts from



the TA-4144 is used, and an indicator lamp burns to show that emergency conditions are in operation. All that is necessary is a simple eight-terminal changeover switch, as shown in the diagram above.—A. F. Schneider, *RCA*.

Proper Method of Tinning a Soldering Iron

After cleaning or reshaping soldering iron tips, I have found that tinning may be simplified by turning on the current in an electric iron or other source of heat and allowing the temperature to gradually rise to a point where the solder just melts when applied to the copper surface. At this point keep the iron temperature during the tinning process as even as possible. High temperatures cause the solder to sputter and prevents an effective quick and smooth alloy.—R. H. Bisbee, *RCA*.

Handy-Andy

I usually carry a bit of joist in the car, about 10" x 7" x 2½" with a hole slightly larger than ½" in diameter drilled in the center. This is very useful for supporting the drive motor in an upright position when replacing a motor cushion by the hammer and screwdriver method.—Maurice Rushworth, *RCA*.

Checking a Shorted Output Transformer

An output transformer may be quickly checked by following this procedure: Disconnect the stage equipment, connect the load resistor and output meter to the output of the amplifier and leave the monitor operating at a low level. Due to harmonic distortion the pitch of the reproduced sound note will appear to double in frequency when the overload point is reached.—F. M. Walls, *RCA*.

Presenting: John E. (Bud) Krebs



JOHN E. (BUD) KREBS, the well known business representative of Local No. 327, Cincinnati, Ohio, was born to be a projectionist, believe it or not. His father, John G. Krebs, was a pioneer union man and a member of the cigar maker's union as far back as 1889. When motion pictures first made their appearance, Old John, as he was affectionately called, decided that the business was the one for him and his sons. So he made the change and became one of the first licensed projectionists in Cincinnati when the city enacted a moving picture operators license law in 1910. Thereafter he served the union as vice president for several terms.

Following in his father's footsteps, Young John (Bud) Krebs became a member of the local. Two younger brothers, George and Edwin, also joined the local. From the very beginning Young John was one of the best liked members of Local 327, for he had an ever-present smile, a fine spirit of fair play, and real ability as a projectionist. These attributes were coupled with a willingness to do anything possible for the benefit of the union or any of its members.

A staunch union man, Krebs however, had never held office until his present post, taking in a period of 26 years. But his name was put in nomination for the office of business representative in January 1944, and he was elected by a 2 to 1 majority over the incumbent, an outstanding indication of his popularity.

Since he became business manager, Krebs has negotiated an increase of from $3.50 to $6.00 per week affecting every member of the local, and union dues have been cut almost in half. Also, when he took office the local owned $1,000 in War Bonds, with the figure having been raised to $10,000 during the past year, and it still is going up.

He is the understandably proud father of a son who now is serving with the U. S. Air Forces in Italy. He also has two grown daughters.

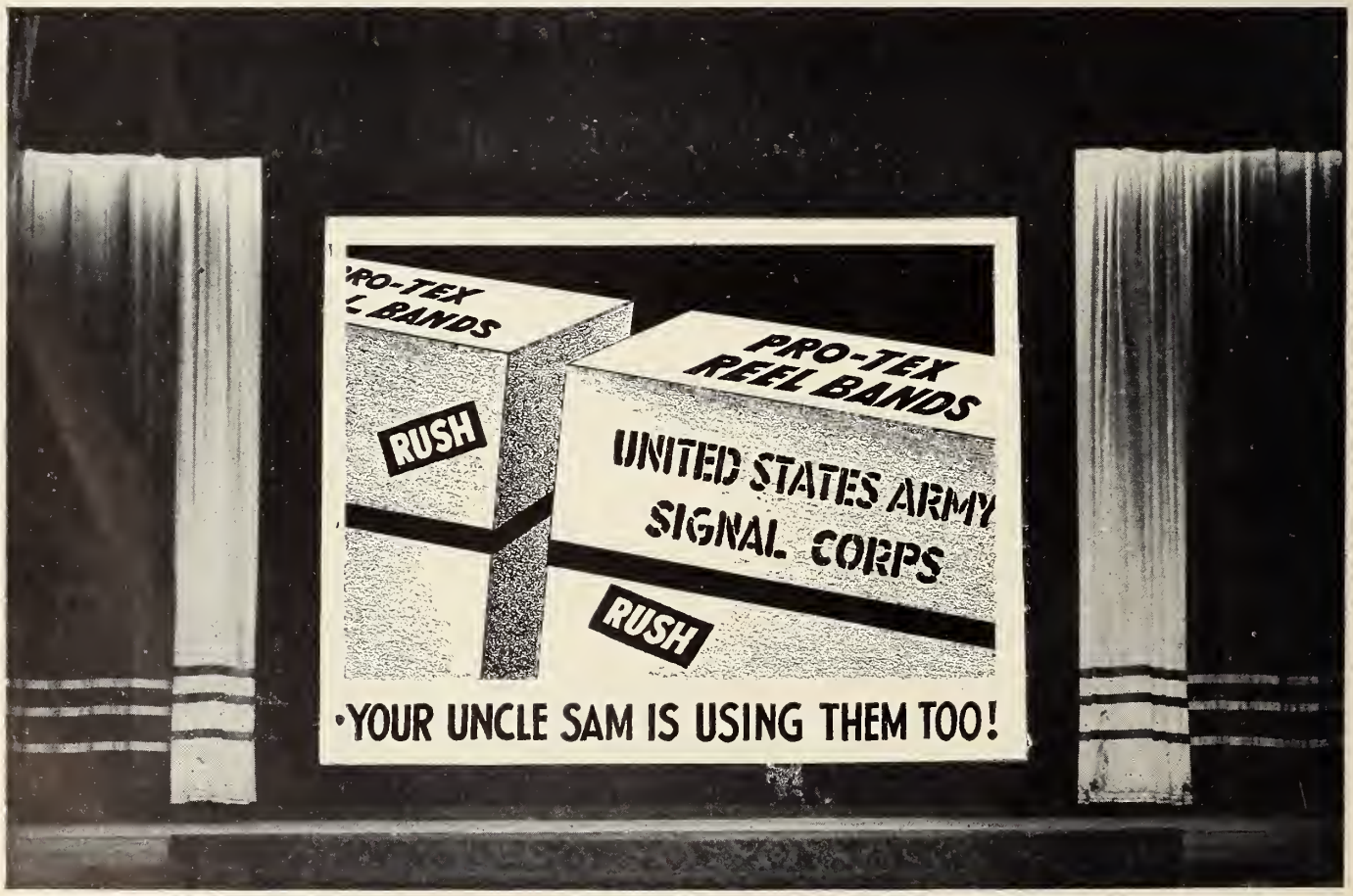
Bud Krebs' door always is open to those in the craft, and he welcomes any I. A. members who may be passing through Cincinnati.

35-MM FILM AUTHORIZATIONS ARE CANCELED BY WPB

The War Production Board has announced that it has canceled all authorizations for the use of 35-mm motion picture film that were issued to movie and news reel producers and distributors prior to Dec. 29, 1944. The action was taken in accordance with a WPB ruling that does not allow authorizations to be carried over to this year, and it is pointed out that it will permit the agency to establish a firm "floor" for future allocations.

All those whose authorizations were made ineffective have been notified and advised to apply for new ones on Form WPB-2165 if they need 35-mm film in the first quarter.

The war agency also has requested information concerning the quantity of 35-mm film used by each company in January, 1945, under its authorization. This will enable WPB to obtain more accurate information concerning past usage and to balance current demand against supply more exactly.



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IN THE SPOTLIGHT

(Continued from page 17)

1944, with 90% of our in-town membership in attendance, and the turnout has held up ever since. Our classes will end in May and will be resumed again next fall.

We began our course with elementary electricity and will work up to the theory of television. We have found that the studies very closely parallel those currently published in I. P. (*Projectionists' Course on Basic Radio and Television*) and we can say that your publication is proving very useful.

Our Television Committee has also formed a correspondence course for our out-of-town members. We are highly recommending that those members who are receiving this course also subscribe to I. P.

The costs entailed are being borne by Local 348. Through the courtesy of the University of British Columbia and the Extension Department, we are given the use of the buildings and equipment gratis. To the best of our knowledge ours is the first I. A. local in Canada sponsoring a technical course to help prepare the membership for any technical changes occurring in the future that may affect our craft.

I hope this information will be of assistance to other I. A. locals who anticipate taking similar action.

Fraternally yours,

LES WALKER
Sec., Television Committee

● Glenn H. Humphrey, secretary of Local No. 337, Utica, N. Y., is now home recuperating from his recent illness. Glenn has the best wishes of his many friends in the I. A. for a complete and speedy recovery.

● The family of Thomas E. Shannon, member of Local No. 223, Providence, R. I., has been notified that Thomas E. Shannon, Jr., 24 years old, Machinist Mate 1/c, previously reported as missing in action, is now officially listed as dead. Young Shannon had a narrow escape from death last year when he went over the side of the sinking destroyer Bristol and was rescued from the Mediterranean one hour later. He was one of six brothers, three of whom are now with our armed forces overseas.

We have known Tom Shannon, Sr., for a good many years and we know of his deep attachment and devotion to his family. Words seem futile at a time like this but sometimes it does ease the pain a bit to know that your friends are with you in your sorrow, and we know that Tom's friends throughout the Alliance sympathize deeply with him and his family in their bereavement.



"Why don't you guys send for your own television books?"

YOU may not want to be disturbed, either, when you receive your copy of the RCA Theatre Television Handbook. Send your coupon and get this essential information on theatre television.

The handbook was designed for projectionists, but also contains news of television developments of interest to exhibitors and theatre managers — such as television reception and large-screen projection. There are chapters dealing with the commercial possibilities of television, handling of programs, audience response.
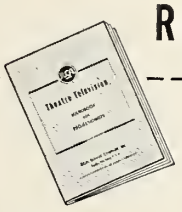
RCA's television experience is backed by a quarter century in the field of electronics and includes television installations at the New York World's Fair in 1939, and demonstration large-screen television projection at the New Yorker Theatre in 1941. This new book is offered by the RCA Service Company as an aid to projectionists and exhibitors in preparing for theatre television.

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SCHEMATIC DIAGRAMS

(*Continued from page* 15)

example, by substituting a rectifier for the transformer in Figure 4-B, then a schematic indicating such change should be made for the benefit of relief men and also for the sake of clarifying the corresponding changes made in the system wiring drawing (Figure 5). Figure 5, properly modified, should be permanently filed in the projection room. available for future projectionists, future service inspectors, or anyone else concerned. Filing a modified equivalent of Figure 4-B with it, will make future tracing of Figure 5 an easier job.

Figure 5 is the wiring diagram of the system of which Figures 4-A and 4-B are the block schematics. These wiring diagrams are made in two forms. Sometimes, instead of connecting wires, they show connecting conduit runs, each conduit being marked as containing so and so many wires. Either method is satisfactory; but if the projectionist should happen to be forced to make his own, he will find the conduit type a little easier to draw; the type of Figure 5 a little easier to understand.

In Figure 5, unlike the block schematics, each connecting line represents *one* wire.

Sound system manufacturers always furnish installation drawings corresponding to Figure 5. Even a manufacturer who refuses apparatus schematics will provide an installation drawing.

But if the sound system was assembled out of component apparatus units made by different manufacturers, and not purchased as a system, then the projectionist should make the equivalent of Figure 5. Or, if the sound installation was bought as a system, but subsequently modified, modernized or otherwise changed, the projectionist should either modify Figure 5 or re-draw it entirely, to show those changes.

Making the equivalent of Figure 5 is easier than making apparatus wiring drawings, and involves only three steps. First, draw in the component apparatus unit outlines—rectangles or circles representing soundheads, amplifiers, network, speakers, etc. As part of this step, put in the connection terminals and apparatus information of each unit as it is being drawn. There is no chance, in system drawings, of confusion resulting from doing these things at once. Second step: draw in the connection wires—or connecting conduits. Third step: add wiring information, such as the note "Coaxial Cable" at the bottom left of Figure 5; or in the case of conduit drawings the data as to how many wires are in each conduit.

CAUTION: Even though these are external wires, *never* trace them with a buzzer, trouble lamp, or other low resistance device. Observe every one of the precautions for tracing internal wiring that were set forth in last month's article —remember that these external wires and internal wires connect.

If it is necessary to disconnect any wires in order to trace them, remove as few as possible at one time; if several must be opened simultaneously, tag them all in advance. A mistake in replacing them may cause serious trouble.

Figure 5 type of drawing, even though simpler than many others discussed in this series, cannot be made during show time. Equipment that cannot be opened with the show running may have to be opened to obtain terminal information and other details. Wires may have to be disconnected in order to trace them.

Further, the projectionist cannot make the equivalent of Figure 5 during show time because, in spite of its *comparative* simplicity it is still difficult enough to need a man's undivided attention; and (like all the other drawings discussed herein) it is *not* useful if its accuracy is only 99.5 percent.

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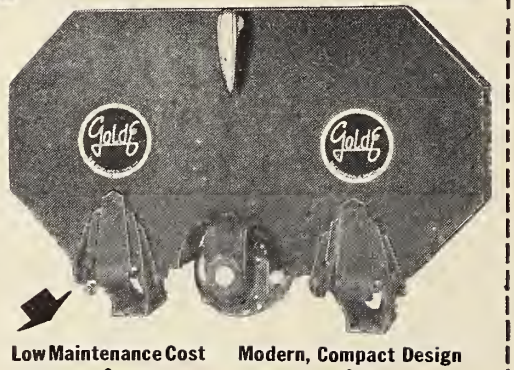
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Double-Checking on Lubrication

PROJECTIONISTS will agree that no factor in maintenance is more important than correct lubrication, yet many projectionists fail to double-check their lubrication procedure.

There are three typical and important faults, (1) use of the wrong lubricant; (2) use of a contaminated lubricant—which is extremely common and goes almost unnoticed — and (3) the wrong amount of lubrication. In connection with the last point, it is not always appreciated that too much lubrication can sometimes do almost as much harm as too little.

As for choosing the right lubricant—the projectionist can't do it—he can only follow the recommendation of a thoroughly reliable supplier. It is not possible for him to make the necessary tests regarding the suitability of a lubricant for use in a projection room. The acidity of the oil is important. The viscosity affects both the flow and the degree to which it will form a continuous, lubricating film over the parts it is intended to protect. There is the vapor pressure—the lubricant may evaporate, or it may become gummy because some of its component liquids evaporate leaving a gummy mess behind.

No manufactured product is more highly specialized than a lubricant. In the matter of choice, any projectionist who substitutes his guesses or hopes for accurate advice from a source of indisputable reliability is making a mistake, and very likely shortening the life of his equipment. He could test viscosity in the projection room, if it would do him any good, but that is about the only factor he can test.

Use of the correct lubricant also requires keeping ample supplies on hand. If a bearing starts to run warm, it can't wait until an order is mailed and filled and shipped and received. The projectionist will be compelled to use something else, pro tem, with whatever risk to almost irreplaceable equipment may be involved. Keeping adequate supplies of every recommended lubricant used in the projection room is an obvious precaution.

Widely disregarded, however, is the fact that the recommended lubricants can become contaminated. One common contaminating material is plain water—simple moisture. Experts trace an unbelievable amount of wear and corrosion to this elementary trouble, which could be so easily avoided if all containers were kept *tightly* closed. What happens in most projection rooms is that the temperature will drop somewhat between midnight and morning, even if not at other times. If the atmosphere can get at the lubricant at all, traces of moisture will condense on the surface of the oil. But oil floats on water—it isn't the other way round—so any water that condenses on the surface of the oil doesn't stay there; it sinks right to the bottom, where it can't be seen. When the lubricant is poured, some of the water gets stirred up with the oil and gets into the bearings. Its presence reduces the lubricating effect, increasing wear, and also promotes corrosion.

A second cause of corrosion has been traced to using new oil cans without first *thoroughly* washing and drying the insides. Many cans are assembled by soldering; corrosive fluxes are used because they work faster; and the factory seldom washes out the excess flux. So eventually the star and cam are being "lubricated" with ammonium chloride or what have you.

A third form of contamination is simple dirt, dust, grime—and, in the projection room, carbon dust. Some of this, again, results from not keeping supplies *tightly* covered. In any projection room using arc lamps carbon dust is going to get into anything that isn't just about hermetically sealed.

Additionally, wear does occur in many



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bearings despite the most perfect attention to lubrication, and tiny particles of metal will accumulate in the oil. The lubricant also may become "contaminated" by changes in its nature after prolonged use—such as the evaporation or chemical deterioration of some of its components, leaving it gummier—more viscous — than it was at the start or ever should be. Periodic changes of lubricant are often specified. They should not be neglected or delayed.

The wrong amount of lubricant—too much or too little—may be applied through ignorance; as on the part of a relief projectionist not familiar with the equipment, or by a new shift coming on and not informed as to what the previous shift had done.

The dangers of too little lubrication are obvious; too much lubricant may not injure a bearing, but it may get on to a commutator, or spatter on insulation (many types of insulation don't withstand oil very well) or it may seep or leak or drip to some point where it can insulate the contacts of a sound circuit. Correct lubrication as to types and amounts used, and flushing out and changing it when specified, can, of course, be best assured by a pre-arranged routine, conspicuously posted, and followed by all shifts and all relief men.

ESTIMATE ON CONSUMPTION IS ANNOUNCED FOR 35-MM FILM

War Production Board officials announced at a recent meeting of the newly organized motion picture industry advisory committee that new quarterly quotas for the use of 35-mm motion picture film by the major producers and distributors—including independent producers—of entertainment pictures are expected to total 255,997,440 linear feet, and new quarterly quotas for news reel producers and distributors 51,714,778 linear feet.

The above quantities are subject to revision in the event of a further increase in military film requirements, the war agency officials pointed out. The expected total for the major producers and distributors represents a cut of approximately 16,000,000 feet from the total for the fourth quarter of 1944, and that for news reel producers and distributors a cut of about 834,000 feet. This small reduction can readily be achieved through further conservation in the production of pictures and will not result in fewer pictures for movie goers, WPB and committee members agreed.

It was announced also by WPB that the methods of alloting the supply of 35-mm film available for industrial film producers and theatrical screen advertisers to the best possible advantage of the war effort were discussed at recent meetings of the industrial film producers and advertising film producers industry advisory committees.

While it has not been determined the amount of film that can be made available for industrial films and theatrical screen advertising, WPB officials said it is expected to be less than previously since increased military requirements of film must be met. Both committees suggested that equitable distribution of film could best be achieved by assigning to each producer a specified percentage of the amount he used in 1944. It was emphasized by committee members that criteria for the allotment of film for one picture as against another could not be established, since almost all industrial films and theatrical screen advertising are directly concerned with the war effort in that they further War Bond drives, conservation and other programs.

PIERCE GETS NEW ALTEC POST

R. E. Pierce has been named Detroit branch manager for Altec Service, reporting to F. C. Dickley, Detroit district manager, the company announces. Mr. Pierce, who is a graduate of the General Electric Engineering School, Lynn, Mass., has served in various engineering capacities for Altec since its inception and goes to his new post from Altec's electronic division at Lexington, Mass., where he has been installation supervisor of technical apparatus for use of the armed forces of the United States.

WOLFE REVIEWS FILM PROGRESS FOR 1944 YEAR BOOK

An article on "The Technical Progress in Sound Equipment" has been contributed to the Encyclopedia Britannica, 1944 edition, by W. V. Wolfe, manager of RCA's Victor Hollywood Film Recording Studios. The article presents the technical developments in the motion picture industry during the past year, and covers the subjects of war standards, 16-mm film, color photography, film and television.



I. A. Elections

L. U. 521, LONG BEACH, CALIF.

Ward R. LaBar, *pres.;* LeRoy A. Ward, *vice-pres.;* Alonzo S. Bennett, *sec.-treas.;* Robert J. Taliaferro, *bus. agent;* Archie C. Frist, Everett L. Covington, Gilbert A. Lahlum, Vernon G. Martz, W. L. LaBar, L. A. Ward and A. S. Bennett, *executive board;* Roy T. Heckman, Paul W. King, Elliott Kirby, *trustees;* Norman D. Owens, Roy T. Heckman, A. S. Bennett, *examining board,* and Ralph E. Addy, *sgt.-at-arms.*

L. U. 618, BLOOMINGTON, IND.

L. Derrell Weaver, *pres.;* Charles Hobbs, *vice-pres.;* Burl McGuire, *rec.-sec., bus. agent;* Chester Grayson, *fin. sec.-treas.,* and Louis Fiddler, *sgt.-at-arms.*

SUBSCRIPTION SYSTEM ENDORSED FOR TELEVISION

Arthur Levey, president of Scophony Corporation of America, in which a 50 per cent stock interest is held by Paramount Pictures, Inc., and 20th Century-Fox via corporate entities, has endorsed the recent statement by J. J. Nance, vice-president of Zenith Radio Corporation, that he believed the best way to create a "box office" for television was to introduce a subscription system whereby those sets equipped with a "scrambling" device would receive the programs.

Last fall Mr. Levey revealed that Scophony was surveying the possibilities of creating a "box office" for television and considers this method as providing an additional source of revenue for major film distributors. He stated that subscription radio, utilizing the exclusive Scophony "scrambling" device registered at the U. S. Patent Office, is the invention of Dr. A. H. Rosenthal, physicist and director of research for Scophony, and would enable the television broadcaster to accurately gauge the size of his audience.

Mr. Levey explained that "Scophony believes subscription radio probably will prove a substantial factor in solving television's economic problem, and we are contemplating supplying subscribers with the latest improved model of the Scophony home television receiver successfully demonstrated in London in 1939, and which shows a picture 24 by 20 inches in size comparable to 16-mm home motion pictures, upon payment of a small installation charge plus a weekly fee of $2.25, which would enable subscribers to amortize the cost of the set in about two years."

The wartime research of Scophony's scientists and engineers in Britain and America, according to Mr. Levey, has steadily improved the clarity, sharpness and detail of the very large television pictures shown by Scophony receivers in varying models suitable for the home, school and theatre, in preparation for the day when television will become a commercial reality. He referred to the fact that television networks between New York-Philadelphia-Schenectady already are in operation and that extension of the service planned by ATT and the Radio Group within several years after post-war would quickly make television available to millions of people.



THE DOCTOR IS ON THE WAY

SLEET AND ICE curtain the road . . . the wind cuts sharp . . . but the doctor is on his way. His duty is at his patient's side, in any weather—at any hour.

THE ALTEC SERVICE ENGINEER too, is always "on call". His special training enables him to spot ailing sound and projection equipment immediately . . . to prescribe and administer so that booth equipment is quickly restored to top running order . . . kept that way. The projectionist can count on the friendly cooperation of the Altec Service Engineer all the time — because his is the service of a *specialist.*



Partners in Public Service

ALTEC
SERVICE CORPORATION
250 WEST 57TH ST.
NEW YORK 19, N. Y.

THE SERVICE ORGANIZATION OF THE MOTION PICTURE INDUSTRY

Motion Picture Projection The Navy Way

By *C. EDWARD WHITFORD, S 1/c*

U. S. NAVAL TRAINING CENTER, SAMPSON, N. Y.
MEMBER, L. U. 376, SYRACUSE, N. Y.

MANY of my brother craftsmen who know I am a member of the United States Navy and a projectionist at the Naval Training Center in Sampson, N. Y., have questioned me about the projection standards here. I have been asked if we exhibited the same productions that are shown to the general public, and if our equipment was the same and our projection as good as in "regular theatres." I hope this article will answer these and many other questions.

The conscientious civilian projectionist makes every effort to produce results which meet the standards of good projection. In so doing, he satisfies his ever present professional pride. The projectionists here at this training center strive for the same results and take the same pride in their fine work, but their efforts are motivated by reasons other than those professional. They use their specialized knowledge to help win the war, and you may be sure that until this is accomplished they, their shipmates, and those who make the necessary material, will never cease their efforts.

The running of films used for training purposes constitutes one of the most important features of the projection program here. Beyond a doubt the lessons learned from the viewing of these films have saved the life of many a fighting man, and have, paradoxically, been instrumental in the liquidation of vast numbers of the enemy. Our projectionists derive great satisfaction from the knowledge of this fact and it should serve to make every projectionist, civilian or military, proud of his craft.

The change from civilian to Navy life does not seem to dull the appetite for movies. At our many places of exhibition we never have reason to be concerned because of a "poor house." I refer to the showing of entertainment films, which are exhibited on a scale that makes possible the attendance of all hands. Attendance is voluntary and ample provision is made to accommodate everybody. For entertainment we exhibit the same news reels, feature pictures, etc., that are shown to the general public.

All necessary equipment to make possible the best in projection has been provided. Our results are proof of this. Our 16-mm equipment is extensive and is used chiefly for non-entertainment purposes. The 35-mm equipment is standard and of the latest design. Most of our "throws" are over one hundred feet and our screens are theatre size. Our projection angle is, in most cases, zero. This is ideal as it aids in obtaining an image without "keystone" and in sharp focus over the entire field.

Our "Sullivan Auditorium" where we have a projection installation, is a most modern and complete theatre. Here the finest in stage and screen entertainment is presented free of charge to all hands—a custom that prevails at all other places of exhibition at this training center.

The projection room presents an appearance which would elicit high praise from any projectionist. The room is of ample size and fluorescently lighted. The deck (floor) is painted a light shade of gray. All bulkheads (walls) are light in color, except the one containing the projection and observation ports. This



Precision reflectors for replacement in all types and makes of projection arc lamps. For sale by most Independent Theatre Supply Dealers.

THE STRONG ELECTRIC CORP.
87 City Park Avenue
Toledo 2, Ohio
The World's Largest Manufacturer of Projection Arc Lamps.



is painted a dead black for better visibility of the screen. The room and its equipment is a model of careful planning. Each piece of equipment is so placed as to be easily accessible for efficiency of operation, cleaning, repair and inspection.

The equipment consists of two projectors, a high intensity spot lamp, and a double-deck stereopticon. The sound system provides a double channel. Power for the arcs is provided by a generator and rectifier. Projector lamps burn Suprex carbons. The rewind table is of steel and mounts an automatic enclosed rewinder and a twin crank hand rewinder. Arc gases are exhausted by a system employing a suction fan. All film is stored in a sectional fireproof vault.

Our other projection rooms are not identical, but there is little difference and the same stringent rules of cleanliness, projection technique and conduct of personnel apply to all. One of these rules, that of cleanliness, is a Navy *must* and can be disregarded by none. This is one of the first facts learned by a Navy recruit and by the time he has finished his recruit training and has been assigned as a projectionist, it is second nature to him. It is no accident that ours is the cleanest Navy in the world. The projection equipment is cleaned at the conclusion of each running or at the end of each day's work, as the case may be.

Film magazines, projector and sound mechanisms are painted white inside. Constant care is necessary to keep them spotlessly free from oil and dust. The covers of the amplifiers and power units are removed and the interiors dusted. Tubes are removed, dusted and contacts inspected. Daily cleaning of arc lamps allows no carbon residue to accumulate.

The light color of the deck requires special attention of the hands and knees variety. There is a regular and frequent inspection by an officer performing this duty. There is also an inspection by the fire department. The fire security inspection includes a check on all fire extinguishers, which are kept at the peak of effectiveness. No smoking is permitted and no rags or refuse are allowed in the projection room.

Inasmuch as cleanliness alone does not insure good projection, but only contributes towards it, another rule of technique is in effect—the inspection of film. Most of the film we run is shipped on thousand foot reels. This reduces fire hazard and makes it possible to run the film elsewhere on projectors that do not accommodate a larger reel.

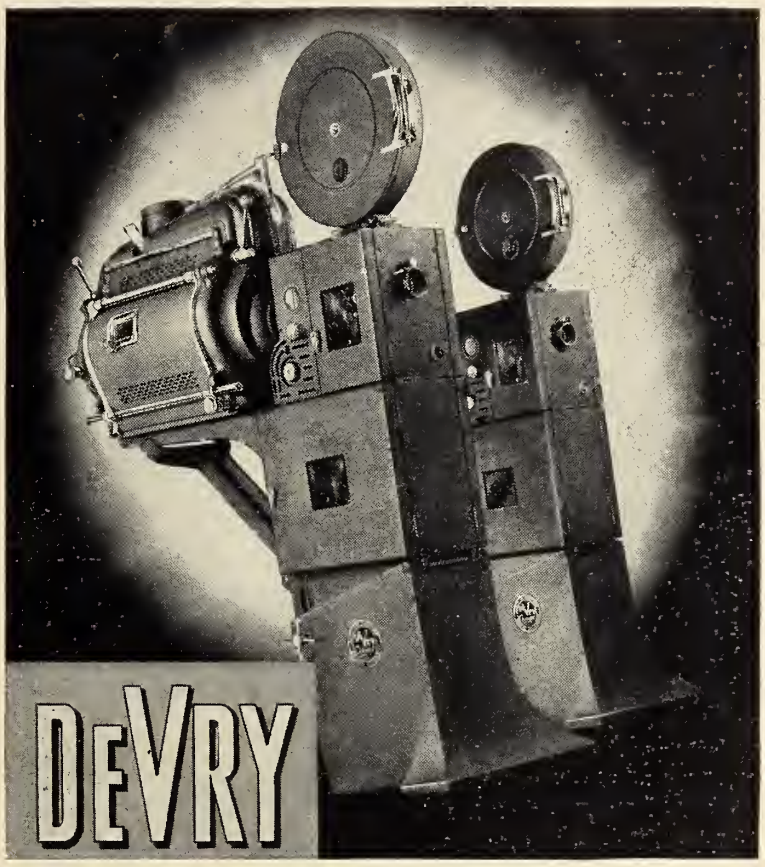
Film inspection includes *all* film and must be made before projection. A written report is made of the condition of the film before, and in some cases, after running. This rule of inspection applies even if the film had just been run off in another projection room and its condition reported as excellent.

Worthy of note is the fact that a provision has been made for inclusion in the report of a statement of the "Entertainment Value" of the prints. Of course, this applies only to entertainment films and refers not to the quality of the picture's production, but to the physical condition of the film as it affects the enjoyment of the spectators.

Projectionists work a regular Navy day regardless of the time required for projection. This time does not include the running of entertainment films. *In every projection room it is required that two projectionists be on duty at all times.*

Our method of presentation eliminates the necessity of any man missing the beginning of a picture. The entire audience is assembled and seated before the performance and remains so until its conclusion, at which time all hands arise and sing the National Anthem, accompanied by a sound and visual film.

In conclusion I will add an important fact. Our projectionists are conscientious workmen, not because of rules and regulations, not because they are held ac-



PROJECTORS WORTHY OF A PROUD NAME

A PROUD NAME in the motion picture world, DeVRY is justly proud of its new 35mm motion picture projectors for which orders are now being accepted. Into these streamlined, rugged, durable and trouble-free essentials to audience satisfaction has gone a wealth of engineering knowledge and experience. Back of their sterling performance in the theater, are new manufacturing techniques, improved machinery, broadened facilities—and the skilled craftsmanship of men who have earned their FOURTH Army-Navy "E" award for excellence in the production of motion picture sound equipment. RESULT: a theater projector that exceeds generally accepted commercial standards in every respect. Coupon will bring you facts of importance.

4 Time Winner

DeVRY alone has been awarded four consecutive Army-Navy E's for Excellence in the production of Motion Picture Sound Equipment.

BUY WAR BONDS

DeVRY

New York • CHICAGO • Hollywood

DeVRY CORPORATION, Dept. IPJ-B2
1111 Armitage Ave., Chicago 14, Illinois
Please send details about the NEW DeVRY 35mm Theater Projectors and Sound Systems.

Name .....

Address .....

City ..... *State* .....

Theater ..... *Capacity* .....

SIMPLEX PROJECTOR AIDS IN MARCH OF DIMES DRIVE

Even though Simplex projectors have been standard equipment in show houses of New York's Times Square for many years, it is news when one is being operated right in the middle of the square itself. That's actually what happened when Loew's, Inc., and National Theatre Supply collaborated to furnish the projector, rectifier and lamp to aid in the March of Dimes campaign against infantile paralysis.

The equipment was set up for rear projection at the base of the model of the Statue of Liberty which stands at 43d Street and Broadway. There was a continuous showing of "The Miracle of Hickory" in the afternoons and evenings during the drive. The picture, starring Greer Garson, showed the use of the March of Dimes funds during and after the 1944 polio epidemic at Hickory, N. C.

RED CROSS USES MOVIES IN HOSPITAL WORK

According to the American Red Cross movies are "tops" among its recreational activities for wounded service men in military hospitals, with films of current pictures being shown by the organization in the hospital lounges for ambulatory patients. A more recent accommodation for bed patients is the showing of movies on the ceilings of wards.

The Army and Navy have recognized the need for recreational activities in the hospitals as it relieves the tension of military life, it is pointed out, and these programs must be suited to bed patients as well as to those who are able to get up and around but who are not well enough to be discharged.

These hospitalized soldiers and sailors, however, are not the only ones in uniform who like movies, the Red Cross notes. In North Africa, in Rome, and elsewhere, the Red Cross has taken over theatres where movies are shown regularly to houses where the SRO sign is generally present.

Soldiers in the field also are provided with movies by the Red Cross. Operating in France today are 38 cinemobiles, trucks which carry complete facilities for showing movies even in daylight hours, to men far behind the front lines.

This Red Cross program, which started out as a purely recreational activity, has developed into one of the finest morale boosters in the armed services.

(Continued from preceding page)

countable for such things as careless destruction of film or improper sound level, but rather because they want to be good Navy men.

The Navy has given them and their craft a job to do to help win the victory. They know it is desirable, if not obligatory, that they shall apply to that job their knowledge and their best efforts to the fullest. Not only military projectionists but all members of the craft should feel gratified that their craft and fellow craftsmen are represented in the fight.

We derive constant satisfaction from the knowledge that the instructive films help create the wonderful fighting man that is the U. S. Navy sailor. We are gratified in helping our craft bring to him the relaxation he so richly deserves. We know these men will, by their deeds and sacrifices, repay our efforts, so small by comparison, with that priceless gift—VICTORY!

SIGNO-MARKER

The accurate, neat method of placing changeover signals on film is available at your dealer, or write direct to

•

CLINT PHARE PRODUCTS

282 E. 214 ST. . EUCLID 19, OHIO

KLEINSMITH ELECTED V. P. BY NATIONAL CARBON CO.

C. O. Kleinsmith has been elected a vice-president of the National Carbon Co., Inc., a unit of Union Carbide and Carbon Corp. He formerly was general sales manager of the company's "Eveready" products, and before that appointment was sales manager for Eastern United States.

D. B. Joy has been named general sales manager for Carbon products, it was further announced. Mr. Joy joined National Carbon in 1923, and in 1941 became assistant superintendent of the Fostoria factory, and made products manager last year. R. P. Bergan has been appointed general sales manager for the company's consumer and related products.

NEW CONTRACT FOR DeVRY

A new government contract for motion picture sound equipment for the United States Navy and Marine Corps has been placed with the DeVry Corporation, Chicago, indicative of further official endorsement of the craftsmanship of this organization, which already is a four-time Army-Navy "E" award winner. The equipment specified in this latest contract is to be used for combined training and entertainment purposes and is additional to the specialized "hush-hush" training equipment DeVry has been building for the synthetic training program of the Bureau of Aeronautics, U.S.N.



NEW PROJECTION ROOM PLANNING BOOK ISSUED BY NTS



National Theatre Supply has issued a new edition of their projection room planning book in order to enable architects, engineers, contractors and theatre owners to plan post-war projection rooms for greatest operating efficiency of projection, sound and lighting equipment for new and remodeled theatres. According to A. E. Meyer, manager of the company's projection equipment division, the new book contains a number of new and unusual features not found in previous editions.

The new features include a unique phantom illustration showing both projection and sound wiring, illustrations of all essential projection and sound equipment, many new and helpful wiring diagrams, floor plans, and a listing of all essential equipment and supply items necessary for complete projection room equipment.

The book is available to all interested in post-war theatre planning and may be obtained by communicating with National branches in all the principal cities of the country.

FIELDS IS NAMED CONSULTANT ON STAFF OF RCA MEXICANA, S.A.

J. L. Fields has been named to the staff of RCA Mexicana, S. A., as technical consultant to RCA film sound recording licensees in Mexico, and will make his headquarters in Mexico City. Formerly he was assistant chief of sales and operations in the Hollywood plant of RCA Victor.

In his new post he takes with him a wealth of experience in the film recording field. Associated with RCA Victor in Hollywood since 1936 he supervised the installation of the RCA recording system in the Warner Brothers' studios in 1937 and 1938, and was placed in charge of maintenance shops and mobile recording equipment activities in 1939. In 1940 he assumed responsibility for the company's recording equipment rental program in Hollywood.

CONTRACT FOR ALTEC SERVICE

Robert L. Lippert Theatre Circuit has signed with the Los Angeles district of Altec Service Corporation for service in all of its theatres. The Twin-City Theatre Corporation Circuit, with headquarters in St. Paul, Minn., also has signed for Altec service throughout its circuit. A deal also has been consummated to service the Associated Theatres Circuit throughout Michigan.

Acclaimed by All!



$3.00 *per copy*

Postage Prepaid

The Projectionists' Book of the Year . . . a **MUST** in Every Projection Room!

TODAY with the limitations on new projection room equipment and with the uncertainties of replacements, it is the duty of every projectionist to know the whys and wherefores of his equipment—what to do and what not to do when the equipment fails to function properly — and how to keep the show going until the service inspector arrives at the theatre.

PROJECTIONSTS' SERVICE MANUAL is a compilation of "At Your Service" items published in I. P. during the past few years and is now brought out in handy book form. All items are grouped according to their classifications and contain sound practical suggestions relating to the many projection room troubles — their causes and how to remedy them. Diagrams and sketches illustrate many of the suggestions offered.

Every projectionist should own a copy of this manual for instant reference and as a trouble guide.

INTERNATIONAL PROJECTIONIST
19 West 44 Street, New York 18, N. Y.

Gentlemen: Enclosed find $3.00 for which please send to me a copy of PROJECTIONISTS' SERVICE MANUAL, postage prepaid.

Name .....

Address .....

City ..... **State** .....

See Your Local Union Secretary for Special Low-Price Bulk Offer



THREE LITTLE WORDS

WHICH MEAN . . .

Better Projection

ON ALL THE "BROADWAYS" OF THE WORLD

Since the birth of motion pictures, exhibitors have looked to our products for leadership in projection. Tomorrow —as yesterday and today—SIMPLEX equipment will continue to prove that—

BETTER PROJECTION PAYS!



Simplex

REG U.S. PAT. OFF.

COMPLETE SOUND AND VISUAL PROJECTION EQUIPMENT

A G·P·E SUBSIDIARY

NATIONAL

INTERNATIONAL PROJECTOR CORPORATION 90 GOLD STREET, NEW YORK, N. Y.

INTERNATIONAL PROJECTIONIST



Los Angeles
Chapter
Motion Picture
APR 24 1945

MARCH 1945

VOLUME 20 • NUMBER 3

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"Oh, she's OLD! Almost thirty!"





At twenty, thirty seems ancient.

At thirty, forty is distant middle age.

At forty, well, it'll be a long time before you're fifty.

The point is that ten years *ahead* always seems like a long time. Yet, actually it passes "before you know it" . . . and you find yourself face to face with problems, opportunities, needs, that once seemed very far in the future.

This is a good thing to remember today, when you buy War Bonds to speed the winning of the war.

In ten years—*only* ten years—those bonds will bring you back $4 for every $3 you put into them today.

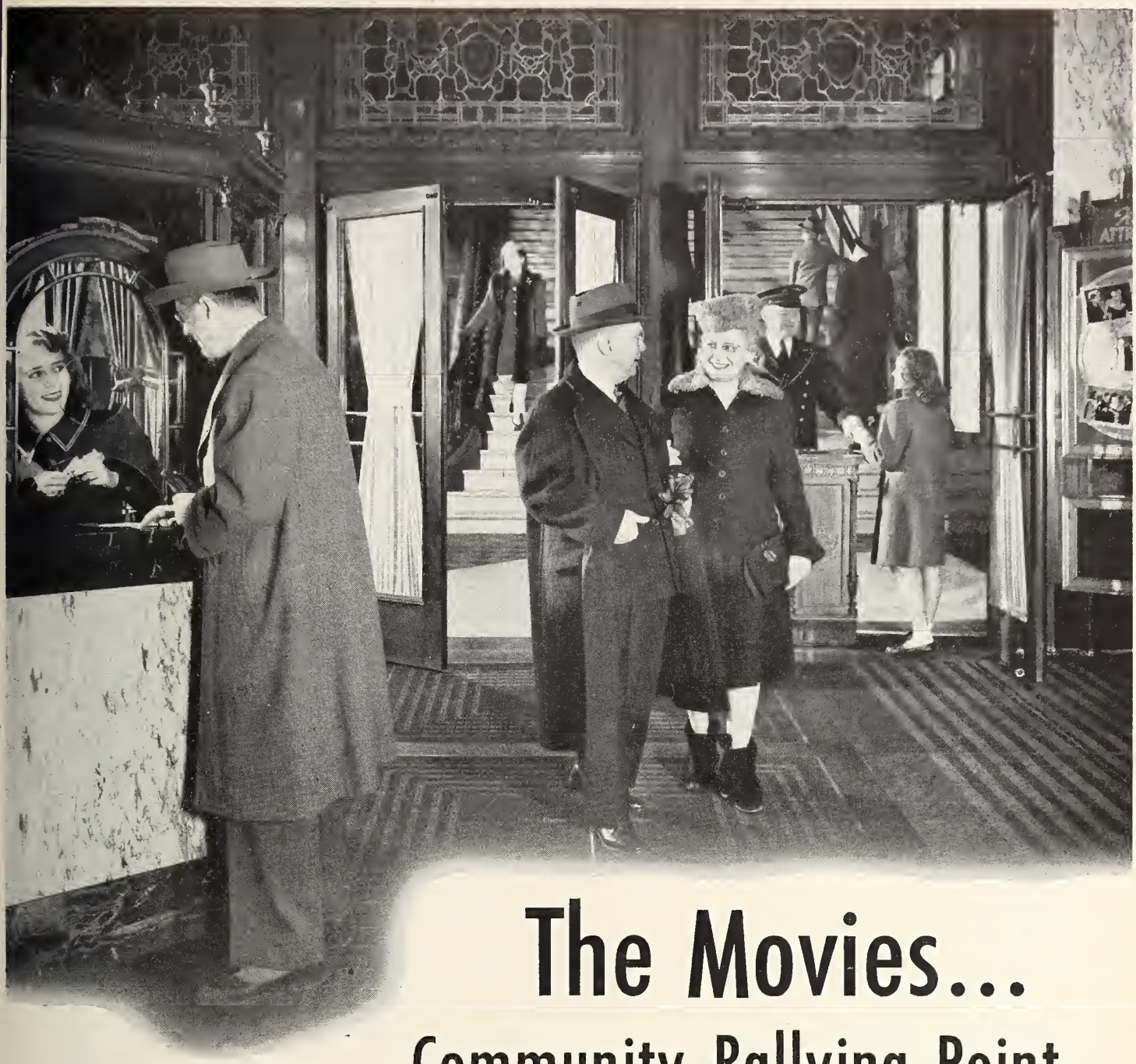
Think of what that money may mean to you in 1955. An education for your children . . . a home . . . maybe even retirement to the place and the life of your heart's desire.

All this your War Bonds can mean to you . . . if you buy all you can today and hold them to maturity.

It won't be long till 1955. Not half as long as you think.

INTERNATIONAL PROJECTIONIST

This is an official U.S. Treasury advertisement—prepared under auspices of Treasury Department and War Advertising Council



The Movies...

Community Rallying Point

WHEN the town meets at the movies, War Bonds sell faster, blood donors hurry to the Red Cross, WAC and WAVE recruiting steps up the pace, the town blossoms out in new Victory Gardens, housewives and merchants band together to fight inflation . . .

Since the beginning of the war, thousands of exhibitors have contributed hundreds of hours of showing time. They and their staffs have worked day and night to make neighborhood and community movie audiences a vital factor in winning the war.

Yes, throughout the nation, one of the most effective rallying points has proved to be "the movies."

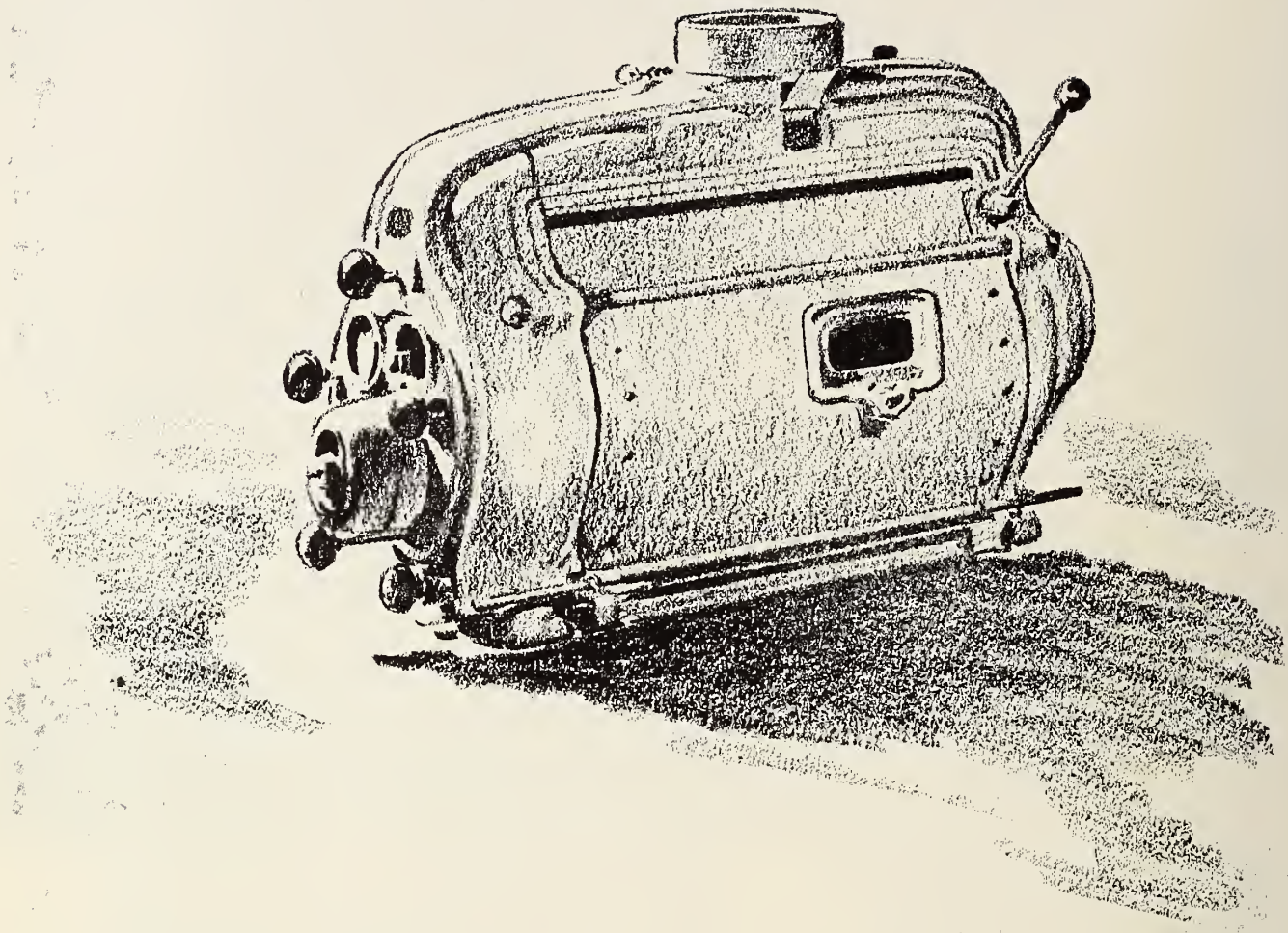
One of a series of advertisements by KODAK testifying to the achievements of the movies at war



Eastman Kodak Company, Rochester, N. Y.

J. E. BRULATOUR, INC., *Distributors*

FORT LEE CHICAGO HOLLYWOOD



Strong has made it possible for even the most modest theatre to have the utmost in projection lighting. As the only projection arcs manufactured complete within one factory, Strong lamps can be so engineered as to guarantee the best screen results. They're sold by the better independent theatre supply dealers. The Strong Electric Corporation, 87 City Park Avenue, Toledo 2, Ohio. The World's Largest Manufacturer of Projection Arc Lamps.

INTERNATIONAL PROJECTIONIST

With Which Is Combined PROJECTION ENGINEERING

W. L. Lightfoot, *Associate Editor*

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Monthly Chat

CURFEW shall ring tonight in the movie world, and from what information is available it is going to ring for a long time to come.

The industry has been 100 per cent cooperative in following the request of War Mobilization and Reconversion Director James F. Byrnes, and it is interesting to note also that management and labor have been vocal only in statements that they will cooperate in the spirit as well as the actual letter of the request. Sadly, this cannot be said of the entire entertainment world, apparently not fully realizing that One World War is being fought that demands sacrifices on the home front as well as the combat areas. For our part we believe that the boys on Iwo and the other millions in the other horrid wonderlands of Mars would pass the ammunition even a little more willingly if they knew they could call it a day at curfew hour. The movie world's war record has been unblemished to date and it is to be hoped that not even one small black spot will mar it during the curfew era, through neglect or otherwise. Projectionists, of course, can police their own houses, and see to it that the show is over in time to sound the "all clear" at curfew.

• • •

Things should be clearer also for those who study the initial article in this issue on 16-mm projectors by Aaron Nadell, editor-on-leave. Mr. Nadell has taken apart a 16-mm projector thoroughly and with words and illustrations, endeavored to clear up some of the fog that has mantled this field in so far as projectionists for regulation equipment are concerned. This is only the beginning of I. P.'s educational series, and from time to time additional articles will "tell all" about other projectors. Due to paper shortages extra copies will not be available, which is a hint that those who want to study the articles from time to time should see to it that they are filed away for reference.

• • •

March is Red Cross Month, according to Presidential proclamation. It is needless to mention each year the tremendous work "the helping hand" of this organization achieves, nor its need for donations, even though all of its activities are financed through voluntary contributions. This is as much a "must" as is the purchase of War Bonds, and that little extra that may be donated during the latter part of the drive, after you have already done more than your part, may be just the bit in cumulative form that will save extra lives, bring cheer to the families of those in the armed services, or make it easier for civilians who are victims of disaster.



THINK OF IT THIS WAY!



YOUR COUNTRY NEEDS MORE COPPER FOR AMMUNITION.

In the photograph are drops of copper from projector carbons, collected from the bottom of a lamp housing. Such collections help make possible .50 caliber machine gun cartridges . . . which can down a Jap Zero, or save a Superfortress for another bomb run across Tokyo.

When you *think of it this way* you realize the importance of collecting the copper from your projector lamps and stripping copper from old carbon stubs . . . and turning it all back into war production channels.

This you can do, through your local salvage committees or through your distributor.

Meanwhile, conserve still more copper by operating your "National" projector carbons under the recommended conditions for maximum efficiency.

NATIONAL CARBON COMPANY, INC.

Unit of Union Carbide and Carbon Corporation

UCC

General Offices: 30 East 42nd Street, New York 17, N. Y.

Division Sales Offices: Atlanta, Chicago, Dallas, Kansas City, New York, Pittsburgh, San Francisco

Keep your eye on the Infantry . . . the Doughboy does it!

The word "National" is a registered trade-mark of National Carbon Company, Inc.

INTERNATIONAL PROJECTIONIST

VOLUME XX MARCH 1945 NUMBER 3

The Operation and Maintenance of a Popular 16-mm Projector

By *AARON NADELL*

Recent widespread and intense interest in 16-mm projection apparatus prompts publication of this article, which describes completely and in detail the operation and maintenance of one popular model of such equipment. Similar descriptions, covering other makes and models, will appear from time to time in subsequent issues.

INCREASING calls upon projectionists to operate 16-mm equipment, and and the obvious growth in post-war importance of such equipment, has interested many I. A. projectionist locals throughout the country, and stirred a demand for more information on the details of such apparatus. One very large local now maintains a school in which members are instructed in 16-mm operation and maintenance. The armed services, of course, use 16-mm projection on a large scale, both for training films and for entertainment. The importance of this type of apparatus not only is increasing but plainly will continue to increase.

Most 16-mm installations are of the portable variety—hence ordinary operation involves such details as proper placement of speakers and correct alignment with the screen, and to some degree assembly of the equipment, in addition to actually running the show. On the other hand, 16-mm does not have the extreme safety requirements associated with standard projection, inasmuch as the film is far less flammable.

Figure 1 illustrates the outside view of the projector-soundhead lamphouse assembly of the DeVry Model RS. The amplifier and the speaker or speakers connect to Figure 1 by plugs and cords. The feed reel, shown at top, left, must be erected to the position in which it is seen in the illustration. Both reels detach from their reel arms, and the arms themselves fold back into the carrying case when the equipment is to be transported.

Lamp House Cover

In Figure 2 we see the lamphouse cover (invisible inside Figure 1) in process of being removed. The condenser is shown at *A*. There are two screws, *B* and *B*, which must be removed to oil the motor—the plate in which they are seated then can be slipped aside, and the motor oil-holes become accessible. The knob, *M*, permits turning the mechanism by hand.

The operating side of the projector is shown in Figure 3. The reel arms in this picture are folded in place for carrying. Pressing buttons *B* and *B*, permits these arms to be rotated out of the carrying case for operation. In Figure 1, in which the projector is seen from the driving side rear, the upper feed arm is operating position. and the reel attached.

Returning to Figure 3, *A*, at right bottom, is the knob that locks the tilting device in that corner; the device itself consisting of the rod just above and left of *A*, which rod can be lowered and held in place by locking *A*, in order to provide projection angle as needed. *C* in Figure 3 is the threading lamp, and *E* is the focusing knob.

Additional details of the operating side of this projection mechanism will be found in Figure 4. Here both reels are shown in operating position—both reel arms extended. At lower right, *A* is the same tilting lock nut previously noted. *B*, top right, is an idler; *C* a guide roller. *R* is an oil-hole at the upper sprocket. Knob *D*, center left, is pressed to open the gate. *M*, center left, a little lower down, is the PEC housing. *G* a bit to right of *M*, is the "lower" sprocket roller. *N* and *N* are two nuts, easily removed, which hold the exciter lamp housing in place. *K* is a nut which can be shifted to right or left to substitute a second exciter if the one in use burns out.

Some of these matters will be covered in further detail in connection with later illustrations.

Figure 5 gives some additional data. Starting at upper left, *O* indicates the top of the gate; *N* is a device which limits the amount of framing play; pin *B* is pulled to open the upper-sprocket idler, shown at *A*. At right, toward the bottom, *C* is the "lower" sprocket pad; *J* an idler; *H* a "filter" roller; *E* is a knob for opening the idler associated with *H*. At the left of the illustration *W* and *Y* are rollers; *X* an idler, and *L* shows the recommended size of the lower loop. *D*, left center, is a knob which is pushed to open the gate.

Intermittent Action

There is no intermittent sprocket. Intermittent action of the film is obtained by means of a claw movement, which does not show in these illustrations. Nonetheless, the intermittent motion so far as the film is concerned is the same as with standard 35-mm equipment, and every projectionist will understand the claw completely the moment he observes it in operation. It is not engaged in the sprocket holes when threading the film. It will engage itself by a shuttle action, when the motor is started or the projector is turned over slightly by hand.

A schematic diagram of the amplifier associated with this projector will be traced, step by step, in a later article.

Figure 6 shows further details of the projection lamp, already partly examined in connection with Figure 2. These lamps are prefocused, and should be found in perfect focus whenever installed for replacement However, *A* is a screw, holding the lamp socket in position, and by loosening *A* the lamp socket can, if necessary, be moved forward or back. *B* is a power plug which must be removed if the motor is to be replaced, and *M*, corresponding to *M* in Figure 2, permits the mechanism to be turned over by hand.

Drive Arrangements

The drive motor is shown, partly disassembled, in Figure 7. The governor adjustment set screw, part of the governor assembly, is shown at *A*, left. It should never be readjusted except in case of trouble. *B* is the cover screw for one of the motor brushes. Oil-holes are indicated at the top; they are reached by removing screws *B* and *B*, of Figure 2, and sliding the plate associated with those screws out of the way.

Exciter Lamp Adjustment

Figure 8 shows details of the mounting and focussing of the exciter lamps. The two screws *N* of Figure 4 have been removed and the housing taken down; screw *K* of Figure 4, by means of which a fresh lamp can be substituted instantly, is now more clearly visible. In Figure 8 this screw is also labelled *K*.

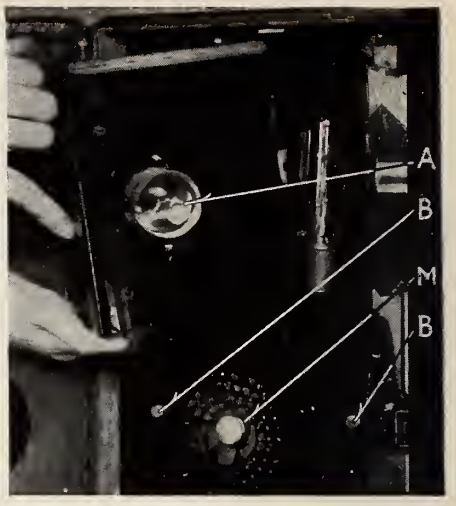


FIGURE 2. ***Removing lamphouse cover.***

A in Figure 8 indicates the lens tube. The functions of screws *B* and *B*, and *C* and *C*, and lockwashers *D* and *D*, relate to the positioning of the exciting lamp, and exciter lamp carriage. When a new lamp is installed, socket clamp screw *B*, on the same side of the carriage, is loosened; the new lamp is properly positioned and screw *B* tightened again.

Then the photocell housing is removed —it pulls off—the cell itself is taken from its socket, and a slip of film installed in position around the sound drum (which surrounds the lens tube). Light up the exciting lamp (see light switch, Figure 1), and then move the exciter lamp back and forth until the line of light showing on the film (at the top of the drum) is of maximum brilliance. Using screw *K*, lock the lamp in that position. Screw in adjusting screw *C* on that side of the carriage until it just touches the lamp carriage, and lock it down with lock washer *D*. Loosen screw *K;* slide carriage back and forth to make sure *C* has been locked in correct position.

If two lamps are to be changed, repeat the same process with *B*, *C* and *D* at the opposite end of the carriage.

Preparing Show

In setting up portable equipment, make every effort to keep the screen at right angles to the axis of projection, even if this means the screen must be tilted slightly. If the projection angle is downward, however, the screen should not be titled upward, but left in vertical position; with an upward projection angle the screen should be titled downward to correspond, if possible.

There may be only one speaker; there may be two. Portable speakers are seldom located behind the screen. They

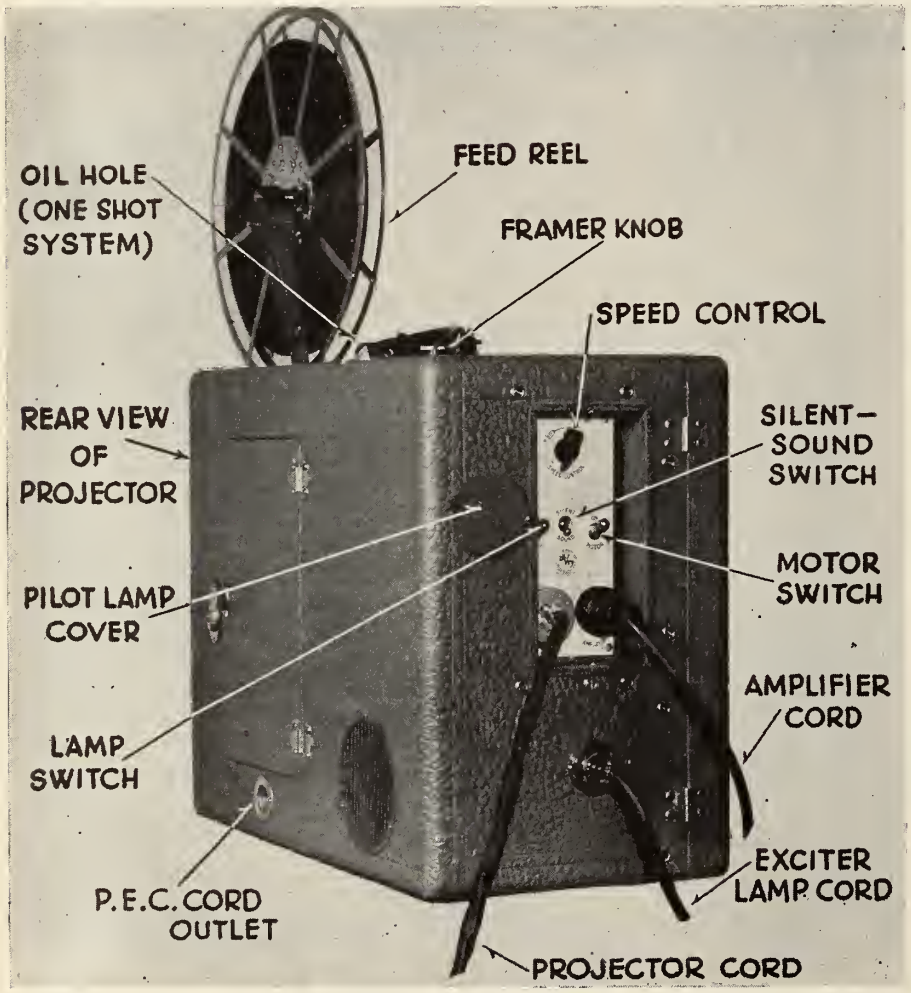


FIGURE 1. ***Projector soundhead lamphouse assembly of the DeVry Model RS.***

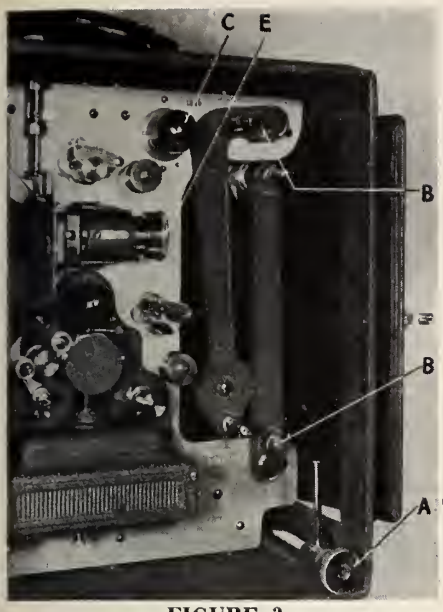


FIGURE 3

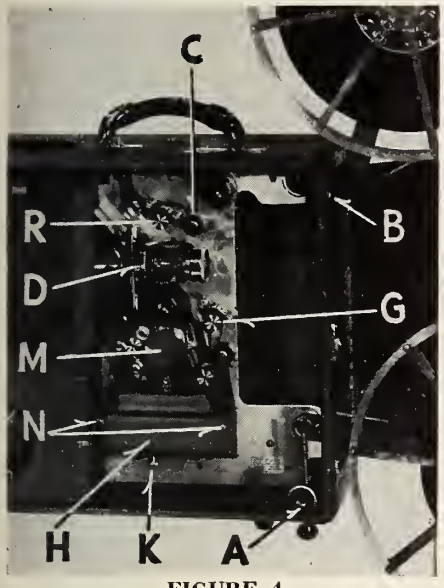


FIGURE 4

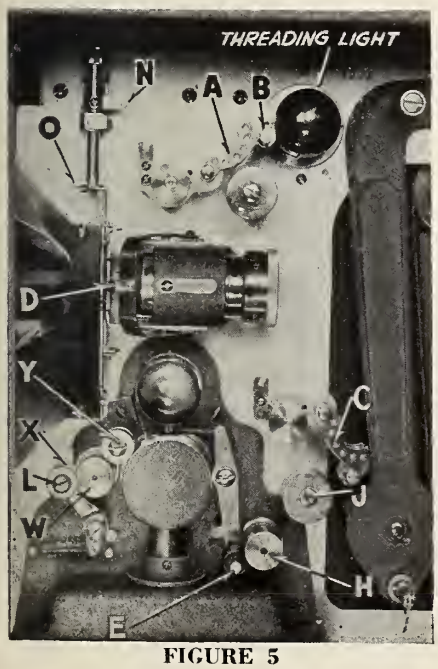


FIGURE 5

may be placed at both sides of the screen, at about middle height, or, if there is only one, at one side of the screen (either side). A single speaker may be placed either above or below the screen—pointing at the audience so far as possible—but a speaker should not be placed so low or so angled that it blares directly into the front rows of the audience. Illusion will never be as good as with 35-mm equipment properly installed, but it is surprisingly good nevertheless. Even though the sound does not originate at quite the natural source the audience forgets that after a few minutes, provided it can hear plainly and no spectators are subjected to the direct blast of the speaker.

The various cables (Figure 1) must be installed by inserting their plugs in the corresponding sockets. This procedure is obvious and should give no trouble.

Threading

Film is shown threaded in Figures 4 and 5. Additionally, each of these projectors has a very visible, extremely clear threading diagram inside the door of the operating side. These projectors can be threaded in absolute darkness after some experience has been gained. Following the printed guide accurately will eliminate all threading trouble. The sprocket holes—there is only one row of sprocket holes in 16-mm film, not two rows as in 35-mm—must be toward the projectionist. The film must come down from the right-hand side of the upper reel. There are exactly 25 frames between the projection aperture and the sound aperture.

The projector is turned over by hand, as a rule, using the knob *M* (Figure 2 and Figure 7) to assure that threading is correct and that the shuttle claw properly engages the sprocket holes. The motor switch and light switch of Figure 1 then start the show.

The "Silent-Sound" switch, Figure 1, is always left in "Sound" position, even when running silent film, unless you want to operate at non-standard speed—standard speed being 24 frames per second, as with 35-mm projection. When that switch is thrown to "Silent" position the motor speed control knob (Figure 1) becomes operative.

Cleaning and Oiling

The pressure plate can be removed—with the gate open—by pushing it upward. It snaps out. It must, of course, be replaced in exactly its original position. Ordinarily, this plate will not have to be removed for cleaning, since it opens wide enough to allow insertion of any soft cleaning utensils—soft cloth, or a matchstick, for example. The lamphouse cover pulls off as shown in Figure 2, giving access to reflector and condenser.

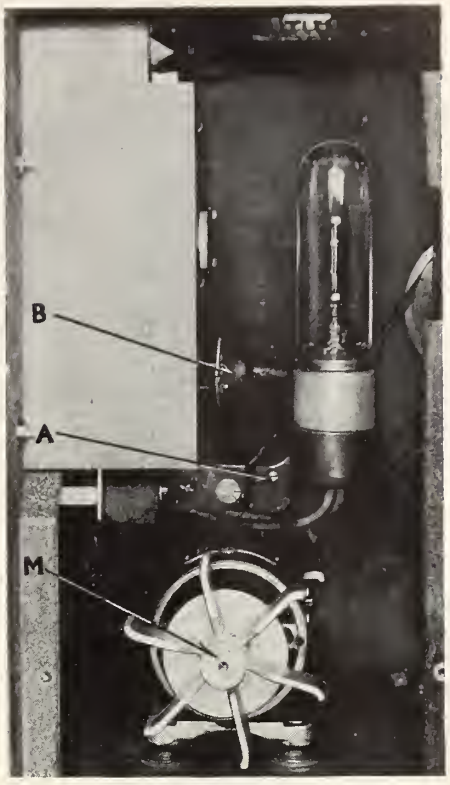


FIGURE 6

The door at the rear of the projector gives access to the "driving side" (rear).

The oiling cup at the top of the mechanism (Figure 1) lubricates all gears. Light mineral oil is recommended. Lubrication of the motor has been discussed in connection with Figures 2 and 7. The motor should seldom be lubricated, being equipped with ball bearings. White vaseline in very small quantities may occasionally be added to the gears. An extremely slight amount of oil, as much as can be applied with a toothpick, may be added at *X* and *Y* of Figure 5 and *R* of Figure 4. Wipe away any trace of excess. Occasionally lubricate the oil holes at the outer ends of the reel arms, avoiding any excess of lubricant.

Ordinary care and projection skill, as normally applied to 35-mm installations, should be quite adequate to caring for any routine troubles this 16-mm equipment may encounter. Remember that electrical connections are not permanently installed, therefore check all cable plugs. Remember that a loose exciting

(Continued on page 12)

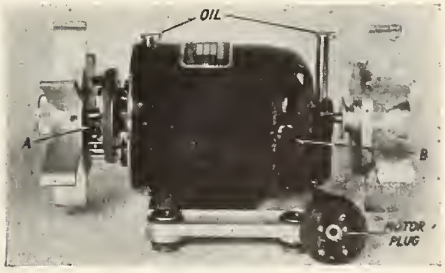


FIGURE 7

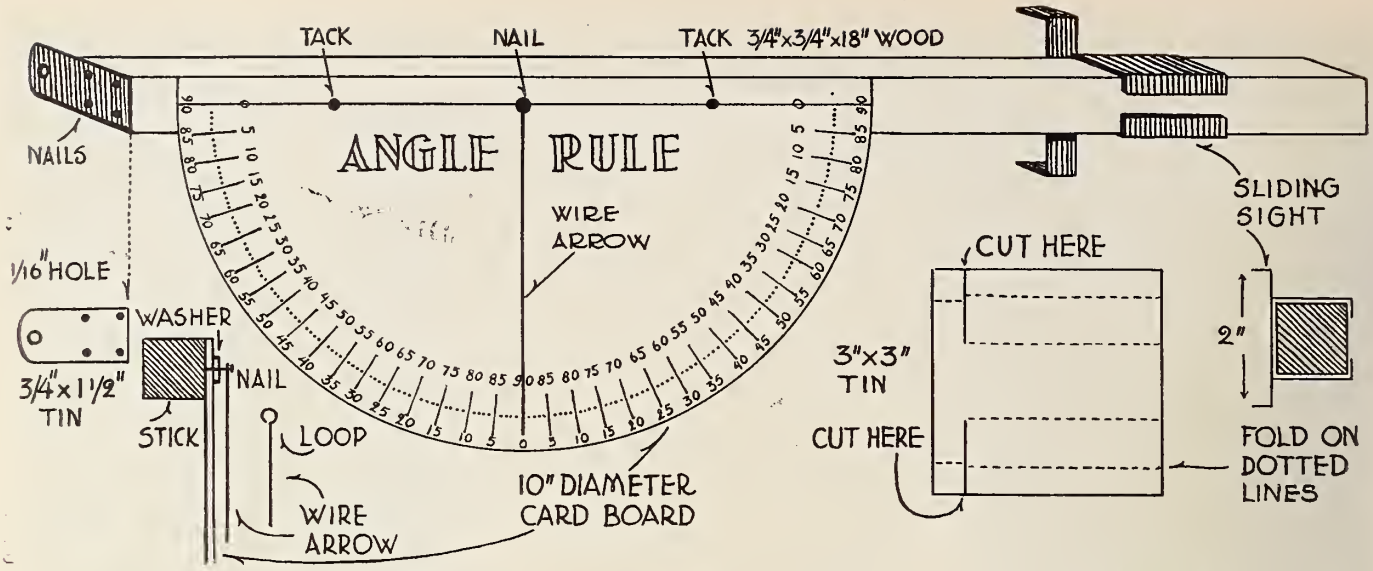


FIGURE 1

Projection Angle Rule

By *J. G. JACKSON*

MEMBER, L. U. 348, VANCOUVER, CANADA

A GREAT deal has been written about projection angle and its calculation, and after giving the subject considerable thought the writer devised a simple and accurate rule that can be made by any projectionist. Specifications are given in Figure 1, and the drawings are self-explanatory.

The degrees on the scale are calculated from an ordinary school protractor. To use the rule, point the stick towards the screen from a point as near the height of the lens as possible. Look through the

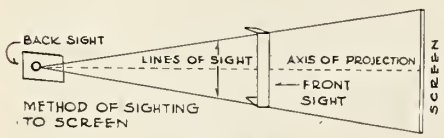


FIGURE 2

peep-hole in the back sight and move the front sliding sight so that its edges are in line with the top and bottom of the screen. When this is done the center line of the rule will point directly to the center of the screen; that is, it will follow the "axis of projection" as shown in Figure 2. The wire arrow will, by gravity, point directly to the value of angle *A* in Figure 3. By carefully turning the rule slightly to the left the arrow will rest against the scale, and the friction will cause it to remain in place so that a reading can be taken.

Definition of Angle

Projection angle, in the true sense of the word, is the angle between the optical or projection axis and a normal angle drawn at right angles to the center of the screen. In other words, it is the angle

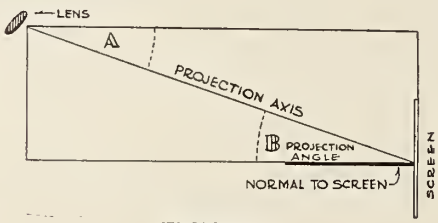


FIGURE 3

of incidence of a ray following the projection axis.

In Figure 3 we note a rectangle showing the projection axis as the diagonal terminating at the center of the screen; the normal axis to the screen is indicated by a heavy line. The projection angle is *B*, which by the laws of simple geometry is equal to angle *A*. Therefore, if we measure angle *A* we have the projection angle. This holds true provided the screen is not tilted, for if the screen is tilted we must calculate the angle of tilt and deduct it from the value of angle *A*.

In Figure 4, the screen is titled with the angle of tilt indicated by angle *X*. Here the projection angle is angle *B* minus angle *X*, or since angle *A* equals angle *B* the projection angle is angle *A* minus angle *X*.

To measure angle *X*, remove the front sliding sight from the rule and place the rule against the frame of the screen as

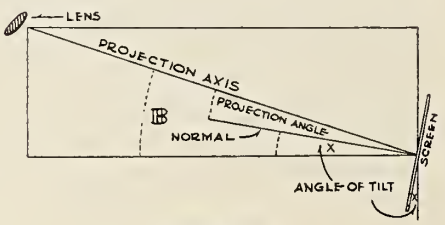


FIGURE 4

shown in Figure 5. The arrow will indicate the value of the angle of tilt. For example, if the value of angle *A* was found to be 18° and angle *X* was 6°, then the projection angle would be 18 minus 6, or 12°.

This rule may also be used to measure the angle of a street grade or the pitch of a roof by removing the front sliding sight and putting a nail through the end of the stick so that it (as well as the back sight) is in line with the center of the stick. It then will only be necessary to line up the two sights with the slope of the street or roof, and the arrow will give a direct reading in degrees.

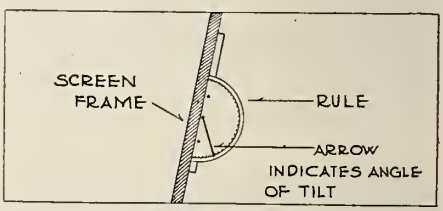
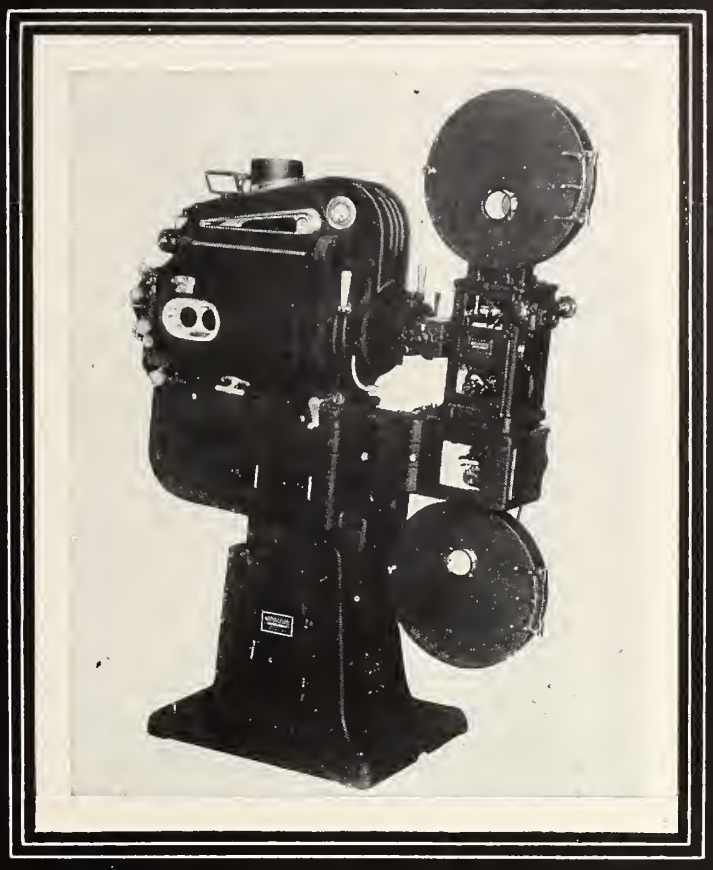


FIGURE 5

BELL & HOWELL EMPLOYES ARE OFFERED OPTICAL COURSE

Bell & Howell has opened a School of Optical Manufacturing, which is meeting in the company's modern optical shop at Lincolnwood, Ill., it is announced. Only 25 employes at a time are instructed in order to insure thorough understanding between students and instructors. The course is based on an effective program of actual shop periods and seminars, with more than 100 applications on file.

One of the more appealing features of the course is that upon completion of it each pupil will have made his own Galilean telescope from beginning to end, working to the close tolerances characteristic of high grade optical manufacture. The course, believed to be one of the finest and most complete of its kind given during the war emergency, consists of 16 weeks, with meetings being held twice a week.



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Proper Operation of Projection Arc Lamps

By *R. O'TOOLE*
RCA SERVICE COMPANY

The author of this article was associated a number of years with a manufacturer of projection arc lamps. His duties, which consisted of the installation and servicing of this equipment, afforded him excellent opportunities to check on the various causes of faulty operation of arc lamps. He sets forth some of his observations about the subject and offers sound practical suggestions for eliminating many causes of trouble resulting from projectionists' lack of understanding of proper arc lamp operation.

WE HAVE three electrical conditions in a lamp which governs its regulation. In their order of importance they are (1) the arc gap; (2) the voltage, and (3) the amperage. We know that if we spread the gap the voltage goes up and the amperage goes down. If the gap is too close, the amperage goes up and the voltage goes down. Therefore, the gap is the guardian over the amperage and voltage and keeps them in the right proportions.

We also know that if the gap is too close we get a smaller gas ball and as we cannot fill the mirror with a smaller gas ball we will not have proper screen coverage. In such cases we crowd the carbon, which, in turn, means carbon waste and poor feeding. Low voltage makes the feed motor sluggish. The arc voltage is what holds the arc in the first place, and a low voltage means more carbon loss or more variation with normal and short trim. It also means low motor voltage.

Amperage is a matter of choice as lamps run at different amperages and they all work.

As for actual lamp troubles, I find the feed probably is the most complained of item. Most of the later lamps are of the constant feed type and constant feeding cannot be obtained with a radical motor. On the relay types this is taken care of in the relay.

On large motors running at full load we undercut the mica between the commutator segments. We do this because when the copper gets hot and expands the mica is forced up from between the segments and holds the brush off the copper. A good example of this is the concrete highway. In the summertime when the slab gets hot the tar comes up and forms ridges. In the winter the slab contracts and we have a cutter between slabs.

For the purposes of insulation we put the mica between the segments, but to undercut it on a large motor is the lesser of two evils. If we leave it flush, the motor will not run; if we undercut it, it will run. If carbon and copper dust get between the segments causing a leakage, it is of small importance as it is not a precision motor doing a precision job. What is medicine for one motor may be poison for the other.

On the arc lamp motor we are not running the motor at full load, nor does it draw a lot of current. Therefore, we do not have the copper or segment expansion to contend with in the first place. If we do not have the first evil why create the second one? We are primarily interested in precision and a motor with a leaky commutator will be erratic in operation. I have had considerable success by turning the copper down flush with the mica and not undercutting the mica. The motor runs with less trouble and over a longer period of time without attention.

On precision motors, such as are used on arc lamps operating at low voltage, the commutator must be clean. Many projectionists have found it necessary to wipe the commutator every few reels. On high speed applications we do not run like materials together due to freezing; on these motors we run a graphite brush on a copper commutator. We use graphite because it lubricates the commutator and prevents unnecessary wear. Too much graphite, however, blackens the commutator with a graphite deposit, which, when it comes in contact with the graphite brush, causes brush chatter or squeaks.

If we use a carbon brush, it will cause unnecessary wear of the commutator. However, should we use a graphite brush on one side and a carbon brush on the other side, the graphite will lubricate the carbon and prevent it from wearing; and the carbon brush on the other side will remove the graphite and keep the commutator clean. Any deposit left by one brush is followed by another material. I have been following this method for years with excellent results—in fact, this method will eliminate most motor troubles.

Another common trouble is the lamp wiring. Most of the installations are replacements of low intensity lamps which run at 25 amps. and 55 volts. When this setup is used the clamp on the lugs of the d.c. line causes very little trouble. But at 40 amps and 27 volts these lugs are quite troublesome.

On rectifiers I find on most jobs that if the line voltage is 230 the rectifier will be set on the 250 volt tap. This means a low filament voltage and to get the amperage the secondary high voltage taps will have to be set up throwing the tungar tubes out of balance. For a better and closer contact, I file the tit off the base of the tungar bulb.

After many years of servicing projection room equipment, I would say that most causes of breakdowns are due to projectionists' lack of thoroughly understanding the proper care and operation of arc lamps. I hope this article will help I. P. readers to gain a clearer and more thorough understanding of their projection-room equipment.

NEW ALTEC APPOINTMENTS

Altec Service Corporation has announced the following new appointments: Frank B. Evans, who has been with the company since its formation in 1937, to branch manager of the Philadelphia office; H. S. Morris, as Eastern representative of Altec Lansing Corporation, in addition to his duties with Altec Service; Carleton S. Perkins, who has been manager of the electronic division, to manager of commercial engineering, and Robert D. Fairbanks, supervisor of the Boston district, to branch manager of the district.

OPERATION 16-mm PROJECTOR

(*Continued from page* 9)

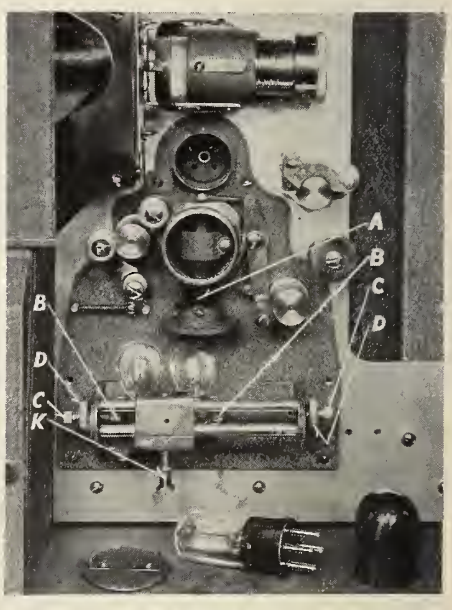


FIGURE 8

lamp, or one not properly aligned as described in connection with Figure 8, may cause noise. This source of trouble can be checked by removing the film, running without it, and observing whether the volume of the noise increases when this is done.

Troubles not known in the theatre include low volume caused by accidental displacement of the speaker or speakers after they have been correctly positioned. Other sound troubles, if any, will be mostly of routine variety.

Projectionists' Course on Basic Radio and Television

By *M. BERINSKY, E. E.*
MEMBER OF INSTITUTE OF RADIO ENGINEERS

IX—Direct Current Meters (Continued)

IN THIS article we will continue with a discussion of direct current meters and their uses in radio testing. The voltmeters and ammeters which were discussed last month are widely used in radio test and repair work. Voltmeters are used for the purpose of checking the potentials at several important points in the receiver or amplifier.

Tube elements such as the filaments, cathode, control grid, screen grid, and plate all are designed so as to operate with certain voltages. These voltages appear at the tube socket terminals and usually are referred to ground, being either positive or negative with respect to ground. The method most commonly used for making these measurements is to place one of the meter test probes on the chassis (ground) and touch the other probe to the various terminals on the tube socket. Voltages found at these points may then be compared with a manufacturer's diagram of the equipment under test. If such a diagram is not available, a receiving tube manual may be consulted for approximate voltages.

Since these meters contain several different ranges care must be exercised when switching in the proper meter range. The wrong choice of selector position may damage or burn out the meter. When choosing a voltage range always pick one that is higher than the anticipated voltage to be measured.

Voltages at the tube socket terminals are not the only ones which are given consideration. The power supply is a very vital part of the receiver or amplifier. A voltage check before and after the filter section of the power supply gives us an indication of the condition of the filter condensers and chokes, and of the power transformer and rectifier tube. Voltage checks also are taken on the automatic volume control circuit, the automatic frequency control circuit (whenever used) and the discriminator output (frequency modulation receivers).

The measured voltages should be within 20% of the manufacturer's recommendations. The ammeter portion of a radio multi-tester is rarely used. An ammeter is always connected in series with the device whose current is being measured. This means that the circuit must be broken and the leads from the ammeter connected to the broken ends. Such a procedure is too slow for radio service work and generally is unnecessary.

Most radio testers are capable of measuring alternating currents as well as direct currents. The meter is really a direct current instrument. When the meter is used on alternating current the a.c. must first be changed into d.c. This is accomplished by means of a copper-oxide or vacuum tube rectifier. The a.c. portion of the tester may be used to measure line voltage, output voltage from the transformer, tube filament voltages, and audio signal voltages.

Ohmmeters

Radio testers usually are combinations of voltmeters, ammeters, and ohmmeters. The ohmmeter is a rapid means of measuring ohms. Resistance may be measured by the volt-ammeter method. This method consists of a voltmeter connected in parallel with the resistance and an ammeter connected in series with the resistance as shown in Figure 9 of last month's installment.

The resistance may be found by the application of Ohm's Law—$R = E/I$. Although this method is very accurate it is also very slow. Resistance can be measured by use of the Wheatstone Bridge but this, too, is a slow process unless the bridge is direct reading. Direct reading bridges are very expensive and are not used by radio servicemen.

The ohmmeter generally consists of a low-current voltmeter and a source of voltage (usually dry cells) connected in series with the unknown resistance. If the meter reads full-scale with the connecting leads shorted, insertion of the resistance under measurement will cause the reading to decrease in proportion to the resistance inserted. The scale is thus calibrated in ohms.

Figure 1 shows several ohmmeter circuits commonly used in radio test equipment; in 1-A we see an ohmmeter circuit for measuring high resistances. The series resistance (R) is adjusted until the meter reads full-scale when the test leads are shorted. When the meter reading changes as the battery ages the series resistance is reduced to compensate for the change.

Figure 1-B is used for measuring medium amounts of resistance. In this figure the series resistance is kept constant but the sensitivity is varied to compensate for the changing battery voltage. The circuit of Figure 1-C is useful for measuring resistances below a few hundred ohms. The unknown resistance is connected as a shunt across the meter, reducing the current reading. Values of a fraction of an ohm can be read in this way. In 1-C the battery is always in the circuit. For this reason the meter should never be left on the "low-ohms" position for more than a short period of time.

The choice of an instrument is very im-

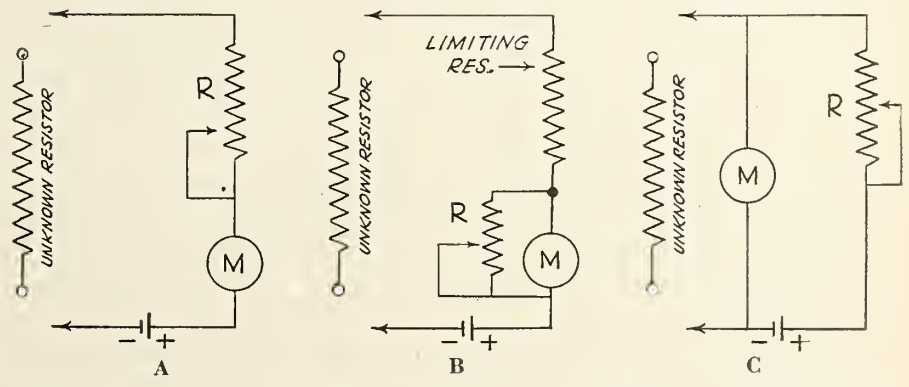


FIGURE 1. *Three basic ohmmeter circuits: (A) high-ohms, (B) medium-ohms, (C) low-ohms.*

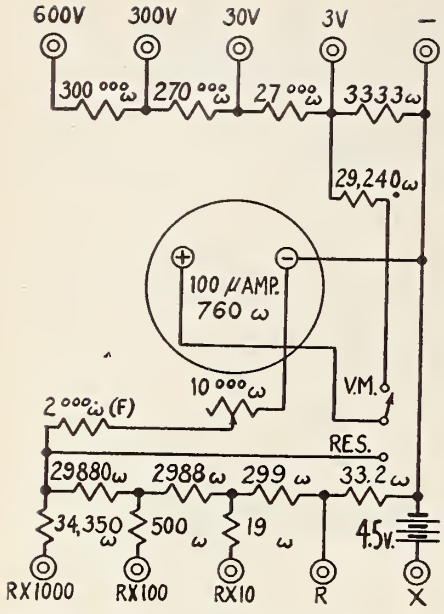


FIGURE 2. ***Weston Electrical Instrument Co. type 3C (model 564) volt-ohmmeter.***

portant to a radio serviceman. If an instrument is carelessly or improperly chosen it may become obsolete and useless in a very short time, and it should be purchased from the long range point of view. A volt-ohmmeter, purchased now, should be easily adapted to television and frequency modulation servicing, since these forms of radio equipment will be in prominent use in the post-war era.

Television receivers use high voltages, as high as 7,000 volts, in some receivers. The trend in the future will be toward still higher voltages, because most receivers will employ the projection principle which calls for the use of projection tubes having anode voltages as high as 50,000 volts. Voltages as high as 50,000 volts would not be measured in practice because of the danger involved. But voltages as high as 10,000 volts could be measured safely if the instrument and its leads are well insulated and if the serviceman takes the necessary precautions.

A good test instrument should be capable of measuring as high as 10,000 volts. It should be able to measure as low as 1 volt full scale. All voltages up to 500 volts should be measured in small steps as 0-1v, 0-25v, 0-50v, 0-100v, 0-250v, 0-500v.

Test instruments are made with various sensitivities. The common meter sensitivities are 1,000 ohms/volt, 5,000 ohms/volt, and 20,000 ohms/volt. Of these the 20,000 ohms/volt meter is best. With it, small voltages appearing across very high resistances may be measured. The vacuum tube voltmeter is even better than the 20,000 ohms/volt meter and can be made to sell at a lower price because the meter does not have to be of such high sensitivity. The author recommends a vacuum tube voltmeter having the voltage ranges listed above.

The ammeter section is not very important and need not be given any serious consideration. When a meter is designed so as to measure current the ranges in common use are 0-1ma., 0-10ma., 0-100ma.; 0-1A, and 0-10A. The unit "ma" means milli-amps. In radio work we deal with very small currents and the milli-amp, which is equal to one-thousandth of an ampere, is a very common unit.

The ohmmeter should be given serious consideration when choosing a meter. The instrument should have several resistance ranges. A special low-ohm scale should be provided. This scale should be calibrated from 0 to about 250 ohms. The scale should be widely spaced between 0 and 20 ohms so as to enable the accurate measurement of very small resistances such as the primary and secondary windings of antenna, radio frequency, oscillator, and intermediate frequency coils.

The resistances of the primary and some secondary windings on power transformers usually are between 1 and 10 ohms. Their accurate measurement is very important in radio work. The medium-ohm range should read from 0-500,000 ohms; the high-ohm scale should extend up to at least 20 meg-ohms (20 million ohms). Such high values of resistance rarely were used in radio equipment in the past. In modern equipment, especially photo-electric devices, resistances as high as 50 meg-ohms are used. Some ohmmeters (RCA Volt-Ohmist) measure up to 1,000 meg-ohms.

Some meters now on the market read inductance, capacitance, and decibels in addition to volts, ohms, and amps. It is not always advisable to purchase such a meter since the additional scales are somewhat unreliable and often misleading.

Figure 2 shows the schematic diagram of a simple volt-ohmmeter. A commercially made multi-meter may be seen in Figure 3. Some servicemen prefer to make their own testers. Because of the difficulty involved in the proper calibration of a home-made instrument, it is not advisble to try to make one unless the means of accurate calibration are available.

The D.C. Wattmeter

The d.c. wattmeter is not an important instrument in radio service work. It will be considered here only because of its instructional value. We know that power is a combination of voltage and current. An instrument which is to measure electrical power must, therefore, be a combination of a voltmeter and an ammeter. Power is equal to voltage times current.

A wattmeter should be so designed that its scale deflection is proportional to the voltage and the current in an electrical circuit. Figure 4 shows the connections for a direct current wattmeter. Coils C and C′ are connected in series with the source and the load. Since these coils are connected the same as an ammeter they are known as the current coils.

Coil V and its limiting resistor R are connected in the same manner as a voltmeter, *i.e.*, across the load, and the combination is known as the voltage or potential coil. The purpose of the limiting resistor is to prevent the coil from taking too much current on high voltage circuits. The circuit operates in the following manner:

When the source voltage and the load are connected, as shown, a current flows through the current coils C and C′. This current sets up an electro-magnetic field around these coils. The coils form the field of the meter in the same way that the permanent magnet formed the field in the Weston meter. Any increase in the current through coils C and C′ will result in a stronger electro-magnetic field. This will tend to increase the deflection of needle N which moves across a calibrated scale. Thus, the deflection is made proportional to the current flowing through the load.

Since this meter is to measure power, the deflection of the needle must also be proportional to the voltage across the load. The voltage coil V is mounted on a spindle and is free to turn in jeweled bearings. This coil acts like the movable coil of a Weston meter. If the voltage through this coil is increased, the current through the coil will also increase according to Ohm's Law. If the current increases, the electro-magnetic field around the coil will also increase.

This meter has polarity the same as the Weston meter. Its magnetic fields are



FIGURE 3. ***Typical volt-ohmmeter RCA Rider volt-ohmyst.***

wound in such a direction that repulsion of the pointer will take place in a clockwise movement. The coils must be connected as shown in Figure 4. If the connections from the outside ends of coil V and resistor R were accidentally reversed, the line voltage would appear between the coils C and C' and coil V. This means that a strong electro-static field would appear between these coils in addition to the electro-magnetic field which normally exists. This field would tend to make the meter give false indications of power. The strong electro-static field would also cause an electrical stress on the insulation of the coils and would cause a breakdown in time.

Earlier in this article we mentioned that a d.c. wattmeter was not used in radio work. Let's see why the d.c. wattmeter has not gained wide acceptance in electrical work as well. We know that watts are equal to the product of voltage and current. The scale of a wattmeter reads directly in watts. This does not give us an indication as to the amount of current or voltage in the circuit at any instant.

Wattmeter Coils

The coils that comprise the wattmeter carry current and voltage. Since one of the coils acts as a voltmeter it will be rated in volts in much the same manner that a voltmeter acting independently is rated in volts. The current coils, too, are rated in their current carrying capacity in the same way that an ammeter acting independently is rated.

A voltmeter and an ammeter should always be connected in the circuit as shown in Figure 4. These meters serve to protect the wattmeter coils from overloads, because the instantaneous voltage and current can be read on the meters and an overload will thus be indicated. Since power equals voltage times current and since an ammeter and a voltmeter are connected in the circuit at all times, the need for a wattmeter is eliminated because it becomes a simple matter

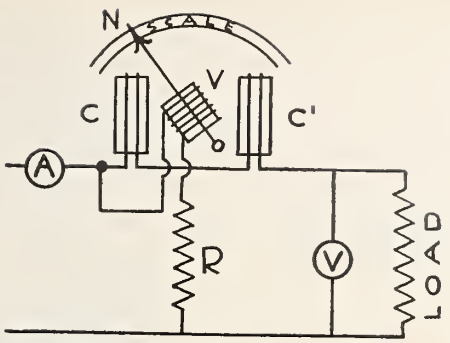


FIGURE 4. ***Direct current wattmeter, with voltmeter and ammeter.***

to multiply the voltmeter reading by the ammeter reading.

The product of the voltmeter and the ammeter readings will give a more accurate indication of power than the wattmeter due to the fact that the wattmeter is subject to stray fields. In alternating current work the wattmeter is always used to measure power. The circuit is the same as in the direct current connection.

In alternating current work the power at any instant is proportional to the voltage across the load, the current through the load, and the cosine of the angle between voltage and current. The a.c. wattmeter is designed to take into account this angle, while the voltmeter and ammeter do not consider it. In a.c. the product of voltage and current is not equal to the power unless the load is a pure resistance. The load rarely is a pure resistance so the wattmeter finds wide acceptance in a.c. power measurements. A more complete discussion together with a description of its uses will be found in a later article.

D.C. Watthour-Meter

The watthour meter is a device for measuring electrical energy. Energy is the rate at which power is being consumed. As energy is the product of power and time, the watthour meter must take into consideration both of these factors. Since power usually is sold on an energy basis, a saving of many dollars may depend on the accuracy of such a meter. The adjustment of such a meter is very important and the calibration is periodically checked for accuracy by servicemen of the utility companies which sell electrical energy.

In principle the watthour meter is a small motor whose instantaneous speed is proportional to the power passing through it, and whose total revolutions in a given time are proportional to the total energy or watthours during that time.

Instead of a fixed pointer as in the wattmeter, the watthour meter has its potential coil wound in the form of an armature, which can make complete revolutions. The shaft of this armature is connected to a recording device consisting of four pointers. These pointers rotate around a calibrated scale similar to a clock dial, and they indicate to four figures, the amount of power consumed over a period of time.

The current coils act as the field of a motor. Current flows through the armature by means of two silver brushes which rest on a tiny commutator. The meter will not read correctly unless a retarding torque acts on the moving element in proportion to its angular velocity. This is obtained by means of an aluminum disc which is pressed on the motor shaft and rotates between the poles of a permanent magnet. Eddy currents are induced in the disc and the proper retarding torque is thus obtained.

FEBRUARY QUESTIONS AND CORRECT ANSWERS

1. **(Q.) Why are soft iron pole pieces used in a meter?**
   (A.) To provide a strong, circular magnetic field.
2. **(Q.) Why is a core used?**
   (A.) To concentrate the field, make it more circular, and to act as a keeper.
3. **(Q.) Why are jeweled pivots used?**
   (A.) To reduce friction to a minimum.
4. **(Q.) Why is the moving coil wound on an aluminum frame?**
   (A.) To provide a means of damping the needle movement (to slow up the needle).

MARCH QUESTIONS

1. **(Q.) Why shouldn't an ohmmeter be left on the "low-ohms" range for a long period?**
2. **(Q.) What type of meter is recommended?**
3. **(Q.) Why isn't the d.c. wattmeter very practical?**

The correct answers to these questions will appear in the next issue.

DeVRY NAMES IRA FLEMING CHIEF FIELD ENGINEER

Ira L. Fleming has been appointed to the newly created position as chief field engineer by the DeVry Corporation, it is announced by William C. DeVry, president. Mr. Fleming for the last five years has been in charge of sound engineering in DeVry's amplifier and speaker division, and in his new post will cooperate closely with government agencies in the installation and maintenance of motion picture sound equipment and panoramic gunnery trainers for the army, navy and marine corps.

His post-war activities will cover the installation, operation and maintenance of theatre projection equipment and the development of an international field engineering service department for DeVry. He formerly was an instructor in radio-electronics at DeForest's Training, Inc., and his knowledge of motion picture sound and television will be made available to exhibitors and projectionists as television receivers become a part of the equipment of the nation's motion picture theatres.

RCA ANNOUNCES NEW SINGLE TEST UNIT FOR SOUND SYSTEMS

The RCA Victor Division of the Radio Corporation of America has announced a new Audio Chanalyst, which is a single unit capable of checking theatre sound equipment for operational breakdowns at any point. Though the unit is designed primarily to simplify and speed up trouble shooting inspection of theatre systems, according to L. A. Goodwin, Jr., manager of the company's test and measuring equipment section, the Chanalyst, type 170A, provides a compact, multiple-duty testing unit that can be used on all types of sound systems.

IN THE SPOTLIGHT



By *HARRY SHERMAN*

IT MIGHT be well for the wage scale committees of local unions to be on their guard when discussing wage scales with certain exhibitors in this country. It long has been a practice of unscrupulous exhibitors to falsify their records in order to show high operating costs and low, if any, profits. Many of our union officials have been taken in by these wily birds and on the basis of the false records presented to them have permitted their members to take a cut in salary so as to help these poor struggling (?) exhibitors keep their theatres open.

We were very much interested in trade press reports of law suits brought against these exhibitors by the producers, who claim that in order to avoid paying a stipulated percentage on pictures the exhibitors altered their records so as to show a reduced attendance at the showing of their pictures. According to the trade press, this practice is not uncommon in the industry, and until recently the producers did little or nothing about it.

In reading the names of the exhibitors accused of falsifying their records we noticed several who, in past years, always put on the crying shawl for Local 306 officials, and swore by all that was holy that they would have to close their theatres unless their projectionists took a cut in salary—a so-called "temporary" cut. It was swell going for them while it lasted. How they must have laughed up their sleeves when they saw how well their act went over. Well, all good things must end and we shall watch with great interest for the outcome of the lawsuits of the producers against the alleged chiseling exhibitors. More anon.

● We just learned that Allen Tindal, the newly elected president of Local No. 253, Rochester, N. Y., has been appointed Chairman of the Monroe County Rationing Board.

● We must admire the persistence (if nothing else) of Senator H. B. Hart of Missouri. Two years ago he introduced a bill in the Missouri Senate requiring unions to file annual financial statements and reports of all transactions. The bill was roundly defeated but Senator Hart, the intrepid politician that he is, recently introduced a similar bill.

Although the Senator from Missouri allows that labor unions have a proper place in this world, he states that "undesirable characters have crept into these organizations and have become troublemakers. Our returning soldiers will not be willing to pay a big fee to join a labor union, and if a public record is made of all financial transactions it would serve to hold down large membership fees."

Senator Hart offers no proof to back up the truth of his statements and we, for one, would be very much interested in learning the source of his charges. We do not remember reading of any legislators demanding that exhibitor organizations, for instance, be required by law to file financial statements but an attack on labor organizations seems to be a favorite political football.

● Here is a bit of irony that is worth noting. A two-alarm fire recently burned out the laboratory of a firm that manufactures, of all things, fire extinguishing chemicals! This bears out what we said many issues ago about fire extinguishers.

● A new "hero" of the press has fallen victim to the vicious propaganda of the anti-laborites regarding the services of projectionists and stage hands in theatres. One A. A. Daugherty, writing for the Louisville (Ky.) Times suggested that the number of projectionists and stage hands working in the Louisville theatres be cut in half and the number of men thus released be sent to work in war plants.



Harry F. Petty

Harry F. Petty, president of the Kentucky State Federation of Labor, and member of Louisville Local No. 163, took sharp issue with this self-appointed WMC and pointed out that the two-man projection room shift was essential for the safety and well-being of motion picture theatre patrons. He called attention to the fact that motion picture film was highly inflammable, and that with two men on duty there was less likelihood of a film fire getting out of control and creating a panic in the theatre audience.

Petty also pointed out that stage hands were necessary to do the many chores around a theatre, such as the care and maintenance of electric motors, the guarding and lowering of the fire curtain in case of emergency, and the many other odd jobs stage hands perform in their course of duty.

Mr. Daugherty's duties as a movie critic for the Louisville Times could hardly be classified as essential to the war effort, yet he takes it upon himself to designate the two-man projection room shift as non-essential. Perhaps the worthy picture critic would like to be locked in a projection room day after day running off thousands of feet of explosive film, exposing himself to the hazards attendant upon the handling of this highly inflammable material. We think he would change his tune in very short order.

● Morrie Seamon and Jimmy Murphy, business agent and secretary, respectively, of the Treasurers and Ticket Sellers Local No. 751, exemplify, in our humble opinion, the finest type of union official it is our good fortune to know. Many of our I. A. brothers visiting New York owe much of the pleasure of their stay in this city to the courtesies of these two men.

● Our deepest sympathies to the widow and daughters of the late Basil Shea, member of Local No. 461, St. Catharines, Canada, who passed away at the age of 41. Shea had been ailing for the last few months but his sudden death was a shock to his many friends.

● Tom Forestieri, old-time member of New York City Local No. 306 and charter member of the famous 25-30 Club, received that dreaded wire from the War Department stating that his son, Anthony, was seriously wounded while fighting in Germany. Shortly thereafter a letter was received from young Forestieri (written

by one of his buddies) advising his parents that he received a fractured right shoulder blade and that his arm and shoulder were in a plaster cast. He was high in his praise of the medical attention he and the other wounded men were getting and expressed the opinion that he soon will be up and around again. We are all with you there, Tony, and hope the day is not far off when you and all our other boys will be heading for home.

● Yes, courtesy and kindness has its own reward. We received a letter from First Class Naval Electrician W. C. Mathews, member of Local No. 537, Jasper, Ala., expressing this thought. Writes Mathews: "I'm enclosing my renewal subscription to I. P. for another two years. I value the magazine for its informative technical articles and really enjoy your column about everyone in general. I get quite a kick out of reading about the fellows I know. There's one fellow whose name recently appeared in your column—his name is Miller and he is a member of Houston Local No. 279, Dallas, Texas. I had the pleasure of meeting him and several of the members while I was stationed in Houston two years ago. These fellows are great guys and know and practice the true meaning of Southern hospitality. I sure enjoyed my three months' stay there and when this war is over I hope to have the opportunity of repaying each and every one of those men for the enjoyable time I spent while in their city."



Eddie Miller

Mathews has been at sea for the past two years fighting in the Pacific area, and it is evident that the courtesies shown him by Local 279 business agent Eddie Miller and his boys are not forgotten.

● Fred Kelsick, the genial red-haired secretary of St. Louis Local No. 143, is among the group of labor leaders supporting city Mayor A. P. Kaufman in his campaign for re-election to office. With labor backing him, Mayor Kaufman is a sure bet for re-election.

● Another example of the triumph of greed over the welfare of the general public was clearly demonstrated in the defeat last month of the Iowa Fire Regulations Bill No. 147, which was sponsored by the Iowa State Association of the I. A. T. S. E., and introduced by George Hartnett of Local 286, Des Moines, and Jim Marksbury, Local 355, Sioux City.

This bill, recommended by the police regulations committee, calls for the annual fire inspection and licensing of all theatres using nitrocellulose or combustible film. A nominal fee of $5 would cover both license and inspection for each theatre having a seating capacity of less than 800, and a $10 fee for theatres with a larger seating capacity. The bill calls for more stringent projection room fire laws—with newly built projection rooms to be constructed with *two* fire-proof doors, and the installation of *two* fire extinguishers in each projection room. No person under 18 years of age would be permitted to operate a projection machine.

According to the Iowa State Association officials the bill was presented at the request of the state fire marshal "as strictly a fire prevention and safety measure for the benefit of the general public." And although the Iowa Theatre Owners Association professes to favor a theatre fire regulation bill, its president issued a statement urging all members to register their "strongest protests" against Bill No. 147. The defeat of the bill followed. This does not mean, however, that the union officials have abandoned all hopes of a theatre fire regulations bill being passed in the State of Iowa, for they will continue with their fight to protect the public and the projectionists against existing fire hazards until such a law has been enacted.

● We present to you past and present presidents of Local No. 528, Kingston, Ont., Canada: Rod Davey, former president and now business manager of the local, and Lorne (Lorney) Heyman, charter member of the local and its present president.

Both Heyman and Davey have been working in the projection room of the New Grand Theatre in Kingston since the theatre first opened in 1938. They are popular with the membership and are untiring in their efforts to make Local 528 one of the outstanding I. A. local unions in Canada.



Lorney Heyman *Rod Davey*

● Los Angeles Local No. 150 held its first class in television several weeks ago. It was attended by over 300 members, in addition to a delegation from the San Bernardino local. President Crowley and his Television Committee have aroused a great deal of interest in the scheduled sessions and they expect an even greater turnout at the next lecture.

● Due largely to the efforts of Gene Atkinson, Chicago Local No. 110 business manager, the chief electrical inspector of Chicago issued an order last month stating that a permit must be obtained from the Chicago Electrical Department for the operation of non-professional (16-mm) motion picture projection machines in every location where such equipment is drawing more than 15 amperes. Inspections will be made by the city authorities, and this amendment to the city electrical code will, we believe, set a precedent for other I. A. local unions throughout the country.



Gene Atkinson

While on the subject of Local 110, we might mention here that Atkinson held a meeting several weeks ago in the union offices with G. L. Carrington and H. M. Bessey, president and vice-president, respectively, of Altec Service Corp., I. A. representative Frank Stickling, and a committee of four I. A. sound engineers, regarding working conditions of the Altec servicemen. The meeting ended in the granting of a 48-hour maximum week for the servicemen on a shift basis of eight hours per day, six days per week. Congratulations to all concerned for their swell sense of fair play.

● We have received many letters from readers in the armed services overseas and we are very much interested in the many different opinions expressed as to the quality and type of entertainment encountered by some of the boys. The writer of the following letter, Sgt. Ray Kirkpatrick, member of Local No. 430, Eureka, Calif., visited the offices of I. P. several months ago and this letter is the first we have received from him since he left for overseas.

Dear Harry:

For several months now I have been rambling around various parts of India and surprisingly enough I have discovered several things about our own industry that surprised me very much, and may surprise you too. Perhaps you and some of your readers will be interested in a few of the things I have seen in this part of the world.

Several months ago I decided to visit the Paradise Theatre in Karachi, Sind (prov.). Here was an opportunity to see the workings of a theatre in a metro-

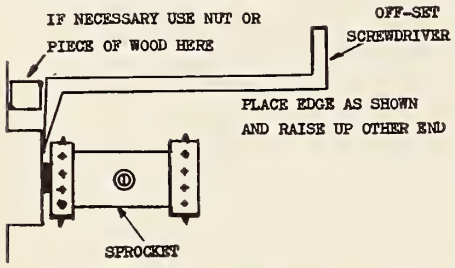
(*Continued on page* 20)

AT YOUR SERVICE

This department is a collection of random thoughts and some not so random: fact, fancy and opinion relating to the man behind the man behind the gun—the serviceman. The prime purpose of this section is to promote a closer relationship between serviceman and projectionist based on a better understanding of their mutual problems through an exchange of news and views, kinks and kicks. To this end, contributions relative to any phase of the serviceman's activities are invited.

Using Off-set Screw Driver for Removing Sprockets

When removing tight sprockets in soundheads and projectors, I use an off-



set screw driver. I have been using this method for about two years and never found one too tight to remove this way. These off-set screw drivers are made in several sizes; it is advisable to always have two sizes on hand.—JOHN R. LOMAX, *RCA.*

Checking Coupling Capacitors

It has been my observation that a leaky coupling capacitor will cause the tube into which the leaky capacitor is connected to have an increase in plate current with applied signal. That is, a class "A" 1-voltage amplifier stage has an increase in plate current with applied signal similar to a class "AB" power stage instead of a decrease or fluctuating d.c. plate current.

Such a condition may readily be tested by applying a high signal from the phototube excited by an a.c. lamp while measuring the plate currents of the various stages.—P. D. COLSON, *RCA.*

Checking Stabilizer Bearings

A reliable check on stabilizer bearings can be made as follows: Thread in a 7,000 cycle frequency loop, set the booth monitor volume control on full and with the amplifier control in normal position, start the projector and check acceleration time for a clear note.—G. E. REIGER, *RCA.*

Conservation of Tubes

As a conservation measure where 2A3 tubes are used in the output stage and 45-type tubes in the monitor amplifier, I have used the 2A3 tubes to replace the 45-type tubes in the monitor after they have become unfit and weakened for use in the main amplifier. These tubes draw a little more filament current than the 45-type tubes but the power transformers are sufficiently oversized to handle the extra current without overheating. No wiring changes are necessary.—A. H. CLOW, *RCA.*

Correcting Projector Leakage

A projector was passing oil from the upper feed shaft, a condition which at the time was unexplainable and contrary to the projector's principles. Upon investigation I found that over a period of operation a surprising amount of lint, hair, fuzz and other foreign material had collected on and around the shaft. Removing the upper feed sprocket and cleaning all foreign particles from the shaft and surrounding area cleared the trouble.

It is suggested that the hole through which the surplus oil is returned be also inspected in such cases.—GLEN HORTON, *RCA.*

Correcting Current Fluctuation of Exciter Lamps

Trouble with exciter lamps in the way of fluctuation that is not readily corrected often will be found in the assembly of the center contact wire. This wire has the center contact button crimped to the end of the wire and while the joint has surprising mechanical strength, it sometimes falls down electrically. Locating the source of heat and of voltage drop, therefore, is obscured until this crimped joint is further crimped with pliers, whereupon the fading of exciter lamps will stop.—A. F. SCHNEIDER, *RCA.*

Repairing Weston 772-Type Analyzer

Sometimes the block on the tester cord of the Weston 772-type analyzers will develop an apparent internal short circuit causing the amplifier fuses to blow, especially when the rectifier tubes are being checked. This trouble invariably can be traced to an arc over and between the pin jacks 2 and 3 on the block underneath the micartha terminal strip inside of the block.

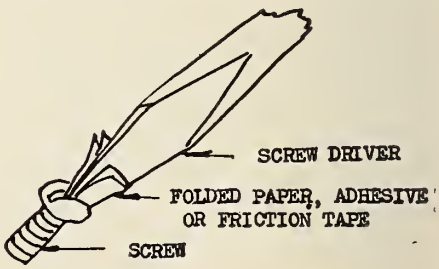
The arcing causes a carbon to form on the block material thereby creating a path for high voltage that exists between the subject terminals. If the carbon is thoroughly scraped and cleaned from the block, the trouble will be corrected. This condition also shows up between the socket prong terminals connected to the same pin jacks. In this case, it might be necessary to cut away part of the separating wall between prong clips before all carbon is removed. —W. H. HOWARD, *RCA.*

Hint on Enlarging Holes

When enlarging holes with a round file, especially where long strokes cannot be made, I wrap a piece of tape around the end of the file to prevent it from pulling out of the hole. This also prevents the file from jabbing the hands and lessens filing time.—R. H. BISBEE, *RCA.*

Using a Screw Driver as a Screw Holding Tool

To use any screw driver as a screw holding tool, use a sheet of paper and a



piece of adhesive or friction tape folded one or more thicknesses as shown in the accompanying sketch. While this is an old trick it may be new to some of I. P. readers.—A. F. SCHNEIDER, *RCA.*

How to Correct Trouble in Low Capacity Coupled System

In sound systems using low capacity coupled cables the opening up of the coupling capacitor between the p. e. cell and the first tube of the amplifier will result in very low volume. A quick temporary restoration of sound can be effected by the external connection of a small capacitor between the external ter-

(*Continued on page* 24)

Presenting: Carlton Lee Cromer



CARLTON LEE CROMER, who has been business agent of Local No. 347 in Columbia, S. C., since 1932, made his entry into the craft way back in 1915 when he started cranking a Powers Model 5. He became a member of Local 347 in 1920, and is a member of the Columbia examining board for projectionists, having held that post about twelve years.

Cromer, who has his own ideas, is a staunch believer in educational promotion activities in the organization, and while he knows there are many very good men in the business he feels that the craft as a whole knows far too little about the "inner workings" of the equipment handled every day.

From 1919 to 1923 he operated the old Baird projectors, those machines with the 3,000-foot magazines and reels which permitted projectionists, by stacking the film above the reel edge, to put an entire program on two reels.

Fellow projectionists remember, back in the 1920's, that Cromer did display work as well as projection and, aided by his wife, who is artistically gifted, created some extremely interesting illustrated lobby displays other than regular stock paper.

They also remember once, however, when he put on a display that actually kept people away from the theatre, because it was too "hot." The theatre manager, it seems, wanted a real "hot" front for the showing of the picture "Adam and Eve." Given the job of building the display Cromer went to town on it, bringing forth a multitude of semi-nude cutouts that something more than upset many of the local folks. Instead of packing the house the box office receipts fell off, and the crowning artistic effort of Cromer's display interlude had to be modified to placate those who were in arms against the original creation.

In 1925 Cromer became intensely interested in radio, devoting most of his spare time to tinkering, which in turn led to more serious work in the way of an eighteen months' course in radio, sound and electrical engineering.

In his capacity as a member of the city licensing board he has hopes that the license requirements will become Statewide, and is working actively with the lawmakers and fire marshals toward that end.

After being elected business manager in 1932 Cromer has done much to better the working conditions in his jurisdiction, and he has seen all theatres in the area unionized. While he is persistent in his union activities even some of the bitterest foes of organized labor admire his sincerity and technique. He is an avid worker for all laws linked with the welfare of labor, both in the City Council and State Legislature. He works closely with the South Carolina Federation of Labor legislative committee.

His current hobby is raising flowers. He hopes some day to enjoy a bit of extensive traveling in the company of Mrs. Cromer. The latter, however, is somewhat skeptical about the program, as she has found in late years that it is almost impossible to plan any engagement because urgent union duties often necessitate its postponement.

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IN THE SPOTLIGHT

(*Continued from page* 17)

politan center of India. Really, Harry, I was dumbfounded at what I saw, for I found something very, very American, with one exception. The one exception was the booking necessary to obtain the ticket of admission. This is conducted in the same manner and plan as in our own legitimate theatres back home, with first, second and third-class admissions.

Inside the theatre the auditorium was strikingly beautiful and 100% American in design. Although I was not able to get into the projection room, a large sign in the foyer stated that it was equipped with the finest American Sound Equipment money could buy, and the performance bore that out.

The program was completely American—shorts and all. Of course, Mickey Mouse is the most popular guy over here. They had two complete shows every night, with intermission between the shorts and feature picture. The proverbial "butcher" was constantly hawking his wares, regardless of whether or not he disturbed the patrons.

I visited another theatre in Delhi, and there, too, the theatre design and equipment used was 100% American. It was hard to understand this because in every other respect this country is so far behind ours.

Three hundred and fifty million, or about 90% of India's population live in its 700,000 mud-hut villages. To me this was truly India and so it was there that I decided to look for my answers.

The Ramgarh Raj. is an average small town Indian theatre, with a seating capacity of 770. I was stunned to discover that the projection room was equipped with the very latest American Simplex and RCA equipment, low intensity lamps and new Simplexes. The projection room had a nice layout and the only equipment I failed to see was any form of automatic changeover warning system. Otherwise it would put many an American projection room to shame. I saw no junk there.

I had quite a chat with the projectionist on duty and it was apparent to me that he did not have too great a knowledge of what he was trying to do. However, he did run a surprisingly good show.

Power sources here are poor and good light is quite a problem. And, believe it or not, in spite of all the excellent equipment in the projection room and on the stage, I found that they used a screen made of a fairly good grade of cheesecloth. I tried to explain the fallacy in using such poor screen material, loss of light, etc., but the only reply I got was that good American screens cost too much money. That's India all over again.

This war has taught me that back home in America, where we are free to organize, free to live the best life on earth, where the leaders and oldtimers of the I. A. provided the younger generation I. A. men with the best wages and working conditions, our rehabilitation problem will not be nearly so great.

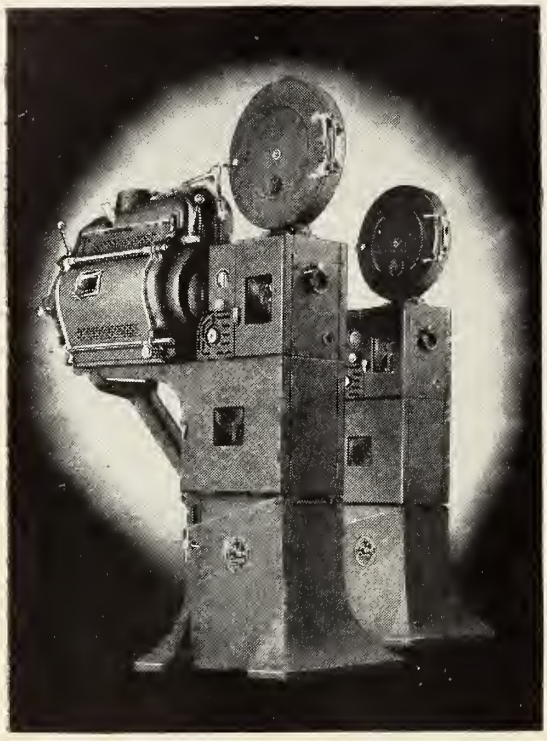
Please give my regards to all the boys, especially the gang in San Francisco, where it was always a privilege and a pleasure to work.

SGT. RAY KIRKPATRICK.

● The following item appeared in a recent issue of the "Exhibitor" and gave us a belly-laugh. Perhaps it will tickle the risibilities of our readers as much as it did ours.

Advantages of the one-man-in-the-booth probably will be claimed by its sponsors after what happened in China, where the sound system broke down during a showing in Chengtu. The audience rioted, and the projectionist fired a shot, killing a member of the audience. The one-man-in-the-booth adherents undoubtedly will point out that there would have been a greater casualty list if two projectionists had started shooting.

● Clarence Jalas, assistant business manager of Chicago Local No. 110, is now taking a well-earned vacation, basking in the warm Florida sun in the company of Neal Bishop, also a member of the local.



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Don't Neglect Cancer

By *CLARENCE C. LITTLE, S.D.*,

MANAGING DIRECTOR, AMERICAN CANCER SOCIETY

TODAY research against cancer stands on the threshold of new and great advances. It already has given us ways of producing and of controlling the production of the disease in laboratory animals, and it has begun to give us knowledge of how cancer cells differ from normal cells. But cancer research needs financial support and more trained workers. It must be given the material aid and security to make it efficient and increasingly powerful.

Few as yet realize the nature of the emergency which cancer presents. There are 17,000,000 living Americans who will die of cancer unless something is done. There are at least 5,500,000 of them who can be saved from death from cancer by simple, direct means.

You who read this are one of the "means" by which these lives can be saved. Learn the danger signals that may mean cancer and the ways in which the risk of cancer may be decreased. Pass this information on to others. Enlist during April in the Field Army of the American Cancer Society. If one of the danger signals appears either in your own life or in that of a friend insist on prompt fearless action. Go to your doctor for examination and advice.

Education alone can save millions of lives even if research does not advance. No one can afford to be too busy to neglect this challenge. It is a choice between intelligent protection of yourself and those you love on the one hand, and ignorant risk of health, happiness and perhaps life itself, on the other.

The American Cancer Society has been for over 30 years the one great National organization devoted to study and development of plans for cancer control. It stands firmly on three fronts where it is face to face with the enemy—Research, Service, Education. It is going forward in support of all of these fields. It is going to take with it millions of Americans, who realize the great need and their power to help.

The American Cancer Society may have a division of its Field Army near where you live. If so go to it for free information. If it is difficult or impossible to reach a local division, write direct to the American Cancer Society, Empire State Building, New York 1, N. Y.

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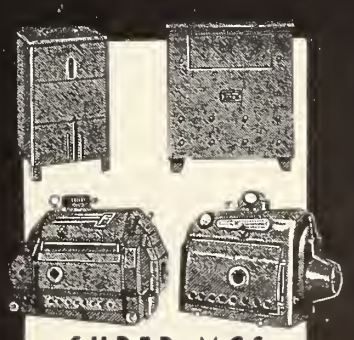
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LETTERS TO THE EDITOR

More on Projection Overseas

To the Editor of I. P.:

The INTERNATIONAL PROJECTIONIST has been coming through to me in quite good time and, needless to say, I am always glad to receive it for it is an excellent means of keeping up with the craft developments back home.

Since my profession in civilian life was, and will again be, that of a motion picture projectionist, it is only natural that projection rooms and the associated equipment should fascinate me. In some of my travels since landing on foreign soils I have had the opportunity to work with several projectors of foreign construction and they provided me with a very interesting study.

Much of my time in Africa was spent in Algiers where there were several theatres, of which a few were first-class houses. In one of these projection rooms they had an installation of two complete projectors on one pedestal with both left and right threading. They were of French construction and were equipped with an a.c. mirror arc.

The sound was also completely French and of a fairly good quality. The projector mechanisms were quite a bit on the order of the old Powers model, except that all gear units were completely housed. The machines were noisy, a characteristic of all the foreign machines I saw.

Other projection rooms I visited in Algiers were all, or at least in part, equipped with American equipment sold through the National Theatre Supply Company of New York. The W. E. sound system is used in most Algiers theatres, and strange to say, they have W. E. sound engineers here who check the sound equipment once a month and make out report sheets very similar to the usual system used back home.

Nearly all the Italian theatres I visited employed German projectors with Italian sound systems, and in most cases, Italian arc lamps. In one small Italian town we occupied, we used the local theatre to run pictures for our own company. I operated the projector and it certainly was a far cry from what I used to run back in Buffalo.

In the Naples area if a projectionist needed a new sprocket gear, or some other part for a given machine sold in the Naples territory, he would take it to the Theatre Equipment Co. of Naples where they would turn out a replacement while he waited. They had elaborate machine shops for that type of work and the quality of workmanship was very high, but the material used was very soft and short-lived.

In most theatres I visited overseas usherettes are employed, and it is customary in these countries to tip them when they show you to a seat. The seats, incidentally, are all reserved. You can well imagine how enthusiastically the service men welcome the usherette idea, as most of them were young and attractive.

After having seen what the projectionists in foreign theatres have to work with, I am mighty proud of, and anxious to return to, my old job in Buffalo where I am a member of I. A. Local No. 233. Nothing compares with what we have back there in the good old U. S. A.!

WALTER A. DUPRE *APO 758, N. Y. C.*

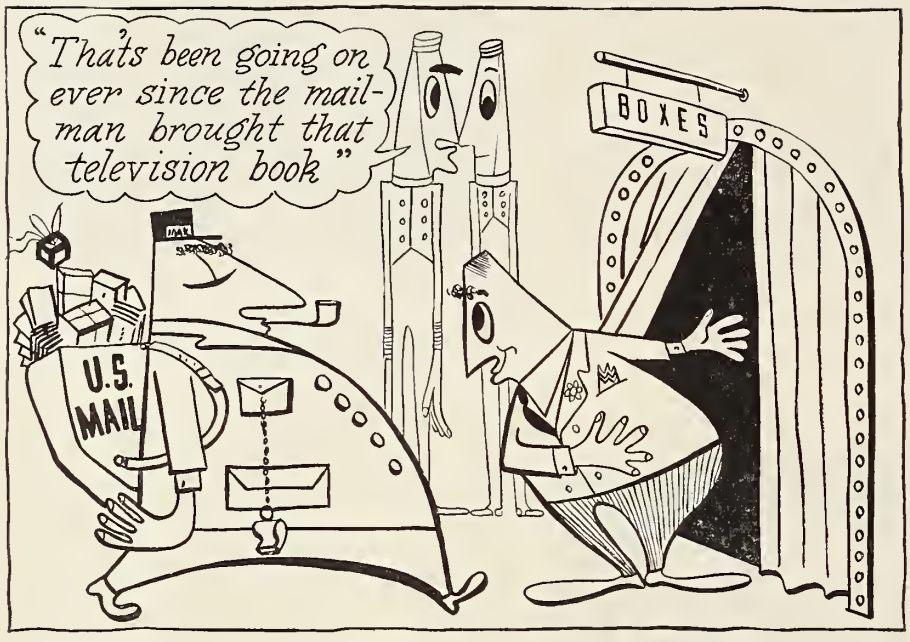
Thanks

To the Editor of I. P.:

Please note change of address. This should rescind letter of October 1944 which cancelled my subscription until receipt of overseas address.

It is but a reiteration of the old saying "You never appreciate a thing until you have to do without it." These past five months have been minus something that did bring a welcomed glimpse into a past occupation and a continual guidance for my return to civilian life. Keep up the good work; I. P. is great. An appreciative reader,

CPL. CHAS. L. SMITH *APO, N. Y. C.*



YOU may not go all out for the mailman who brings your Theatre Television Handbook—but you will be vitally interested in learning the what, how and why of theatre television from the booklet's timely articles and discussions.

The Handbook was designed for projectionists, but also contains news of television developments of interest to exhibitors and theatre managers — such as television reception and large-screen projection. There are chapters dealing with the commercial possibilities of television, handling of programs, audience response.

RCA's television experience is backed by a quarter century in the field of electronics and includes television installations at the New York World's Fair in 1939, and demonstration large-screen television projection at the New Yorker Theatre in 1941. This new book is offered by the RCA Service Company as an aid to projectionists and exhibitors in preparing for the advent of theatre television.

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25-30 Club Notes

THE out-of-town membership roll is steadily increasing. The new members enrolled at the last meeting are Elisha C. Steele and Howard Worthen, members of Local No. 380, Oklahoma City; Gus Hilton, business agent, Atlantic City Local No. 310; Clyde R. Cooley, secretary, Omaha Local No. 343; Harry J. Gurnes, John R. Bartle and Robert H. Poulsen, members of Syracuse Local No. 376.

• • •

Vice-president Morris J. Rotker seems to have hit the jack-pot. He became a grandfather twice within a period of one week—both girls, born to two daughters married to men in service. This double-header left Rotker a bit bewildered, but we are happy to report that he is regaining his equilibrium slowly but surely.

• • •

A movement has been started among the members of the Club to change the meeting hour from midnight to 8:30 p. m. Most of us have at least hit the half century mark and the loss of even one night's sleep is a serious matter. We think the earlier meeting hour would bring out a larger attendance — at any rate it is worth a trial.

J. WALTER DIETZ RETIRES FROM WESTERN ELECTRIC

At the first of the month J. Walter Dietz, industrial relations manager of the Western Electric Co.'s manufacturing department, retired under the organization's pension plan. He had served the company for more than 42 years. On leave of absence for the past four years Mr. Dietz has been a top executive in the government's industrial training program, now a part of the War Manpower Commission in Washington.

Mr. Dietz joined Western Electric in 1902 as a student engineer at its Chicago factory, following graduation from Purdue University. It was soon evident that he had a particular talent for personnel relations and at the end of nine years he had risen to become manager of the company's educational department in Chicago. Since that time he has been active in the fields of training employment, safety and industrial relations at the company's headquarters in New York, and in its factories in Chicago and Kearney, N. J.

WALLACH IS NAMED EXECUTIVE DIRECTOR OF RESEARCH COMPANY

Robert Wallach has been named executive director by Associated Engineering & Research Companies, New York, an organization of inventors, engineers, research men and market analysts. The organization is ready to serve manufacturers seeking new products in the electro-mechanical field and offers a wide range of items, from internal combustion engines to household specialties.

In addition to providing ideas the companies are equipped to furnish working models, complete engineering drawings and a comprehensive market survey covering the products recommended. They will recommend one of their already developed products or devise a new product to meet particular specifications.

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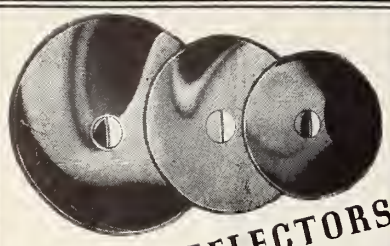
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(*Continued from page* 18)

minals on the sub-panel and the grid of the amplifier panel.

In many of the low capacity coupled equipments loss of sound or very low volume has been experienced due to the opening of the aforementioned coupling capacitors. This condition usually is difficult to locate and correct quickly in an emergency as no measurement will show up the defective capacitor. The simplest and quickest way of restoring sound is to momentarily "shock" the system with a loud signal, thereby restoring the open capacitor connection and consequently restoring the sound.

It is evident that this trouble could be eliminated by the use of parallel coupling capacitors, that is, a coupling capacitor having a value of .001 made up of two .0005 capacitors in parallel. This might cost a few cents more per amplifier but a large number of capacitors could be purchased with the cost of one emergency cell. The failure of one of the two parallel capacitors would become evident by the change of the frequency response characteristic and could be replaced before loss of sound occurred.—W. H. Howard, *RCA*.

Arc Lamp Rectifier Hum Corrected

When I recently had a very bad case of hum from an arc lamp rectifier that was picked up by the PEC transformer in the PS-16 soundhead, I found that revolving the transformer would not cancel out the hum pickup. This condition was finally corrected by replacing the bakelite transformer cover with four thicknesses of 24-gauge sheet iron.—H. M. Morrow. *RCA*.

Operating an MI-1050 Soundhead With Broken Pad Roller Arm

Remove the constant speed pad roller arm and install in place of the broken hold-back pad roller arm. By leaving only one perforation loop between the constant speed and lower sprockets, I find it is possible to run without a pad roller on the constant speed sprocket.—Herbert Barberie, *RCA*.

Using Re-Wind as a Lathe

Here is a method I have followed the past few months where I used a re-wind motor equipment as a substitute for a lathe. For this purpose I secured a number of very small rubber belts, some measuring about 1/32" in diameter and several about 1/16" in diameter. These belts are about four feet long and make a loop of about two feet.

Remove pad rollers that have worn sharp or have become discolored by fire. By holding the roller assembly with a pair of "vise grip" pliers after re-wind and then stretching the belt around the empty reel on the motor side, the motor will spin the assembly sufficiently to grind off all sharp edges of the rollers. Emery paper is used for this purpose. In many cases, rollers that were about to be replaced were made as good as new.—C. H. Atchisson, *RCA*.

Substitute for Resistors

Low resistance resistors are very hard to locate these days, so when they are needed for special purposes I get some Nichrome heater wire. This wire comes in coils and may be obtained from most electrical stores at 50 cents per foot. Measure off what is needed with the ohmmeter and form "eyes" in the end and then connect it across the terminals where necessary. The wire is stiff enough to be self-supporting.—N. Barberie, *RCA*.

Correcting Loop Size

When sound loops are different and one of the loops is either too large or too tight, you can correct the condition by meshing the drive gear in a different position. It only takes one or two teeth on the drive gear.—M. Rushworth, *RCA*.

Correcting Power Unit Output Fluctuation

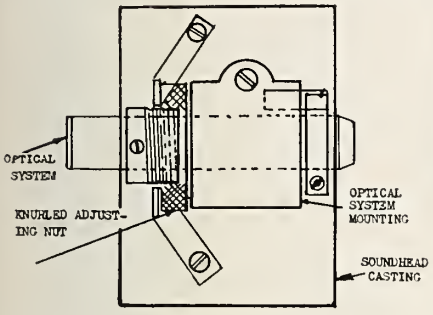
Power supply units using the Tungar bulb occasionally show a fluctuation in the output voltage. In most cases, it has been found that the contact to the shell of the socket is loose. In order to correct this, the socket will have to be removed to tighten. This can be done by remov-



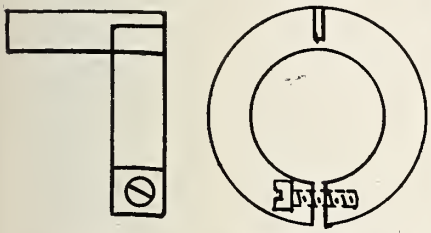
ing the wax from the back of the screws, and then tightening them. Where it is possible, secure the screws by riveting the screw ends inside the socket.—M. C. Deming, *RCA*.

Tool for Adjusting ERPI KS-6607 and KS-6470 Optical Systems

A tool that can be made with a little work and few parts is shown below. Two

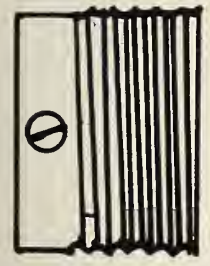


small brackets are necessary for the knurled thumb nut to rest against, and these are fastened to the soundhead by



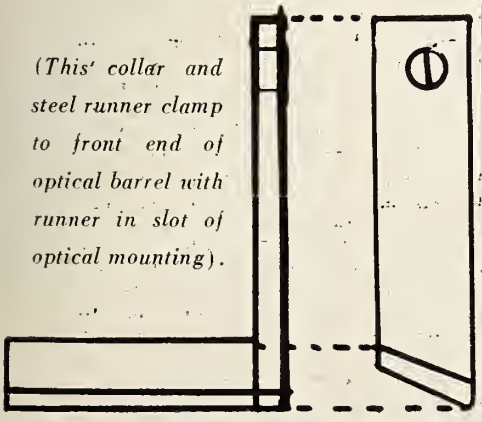
(Two of these required with upright portion formed at opposite angle).

means of the screws holding the optical system to the soundhead. A threaded sleeve which slips over the optical barrel is held in place by means of a set screw,



(Threaded sleeve slip-fit over optical barrel. Brass set screw for fastening to barrel).

and a steel runner clamp is used to hold the front end of the optical system.—W. C. Bowers, *RCA*.



(This collar and steel runner clamp to front end of optical barrel with runner in slot of optical mounting).



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Chicago L.U. 110 Leads Way in Mass Study of Television

IT IS news when some 200 members of a local union sign up for a course in radio-electronics and television, for it means that mass opinion is strongly inclining to the great importance of video in the post-war era. The local in question is No. 110, Chicago, with the foresighted projectionists aforementioned making certain that they are going to be in the vanguard of those who have full practical knowledge of television. It also is believed that others in key cities will follow in the same path.



Officers and members of Chicago Local No. 110 who are taking the radio-electronics-television course at DeForest's Training, Inc., in anticipation of the early advent of television on motion picture screens.

Front row, left to right: Larry D. Strong, Clarence A. Jalas, assistant business manager; Edward J. Halliday, Eugene J. Atkinson, business manager; James J. Gorman, president.

Second row, left to right: C. Butwill, John Koontz, Walter Reiter, John R. Burns, Geo. P. Dravillas, Pasquale Gigante.

Third row, left to right: S. G. King, Joseph Rossberger, Nick A. Chronis, John MacKinnon, Vladimir Desort, Lee S. Owens.

Fourth row, left to right: George High, Francis E. Gorey, Porter Davis, Harry Elman, Howard Lorenz, Stanley Lukes.

Fifth row, left to right: Joseph Omerza, E. R. Reilly, Charles B. McNeill, William Roach, Joseph Canick, Howard G. Blackwood.

Standing in rear, left to right: Harold Miller, Arthur J. Gagnon, Edward Ferney, William Heintz, William C. DeVry, president of DeVry Corporation; unknown, Salvatore Licitra, Morris H. Thacker, A. Ellsworth Hopkins, James Best, Seymour Robbin, William R. Channell, A. Mohaupt, William Hassett, W. Littlewood, and Frank Lebrun.

The course attended by the Chicago members is being conducted by DeForest's Training, Inc., Chicago, pioneers in the teaching of industrial subjects with the aid of motion pictures. One or more additional classes soon will be formed, it is announced.

Eugene J. Atkinson, business agent of the Chicago local, stated that eventually all projectionists in the Chicago area, numbering more than 600, will take the course. "Our union contract with the theatres," added Atkinson, "calls for the employment of television operators when 'television films' are used, and our men are the ones for the job."

While the cost of the course is borne individually by members, enrollment is a union requirement, and every licensed projectionist under the jurisdiction of the Chicago local will be obliged to complete it. It is believed by the local's officials that similar action will be taken by other I. A. local unions in the near future.

Local 110 officials for several months have been studying the possibility of television in metropolitan theatres and the effect its adoption would have on present-day projectionists. Finally, it was decided to prepare for this eventuality by arranging for a course in television for every union projectionist now employed in the Chicago area.

After examining several radio-electronic and television courses now available, it was decided to ask DeForest's Training to outline a course in radio-electronics in which the emphasis is to be put on television. As a result of conferences with William C. DeVry, president of DeVry Corporation and T. J. LaFeber, general manager of DeForest's Training, Inc., union officials decided to adopt the course prepared by DeForest's Training as the official course for Chicago union members.

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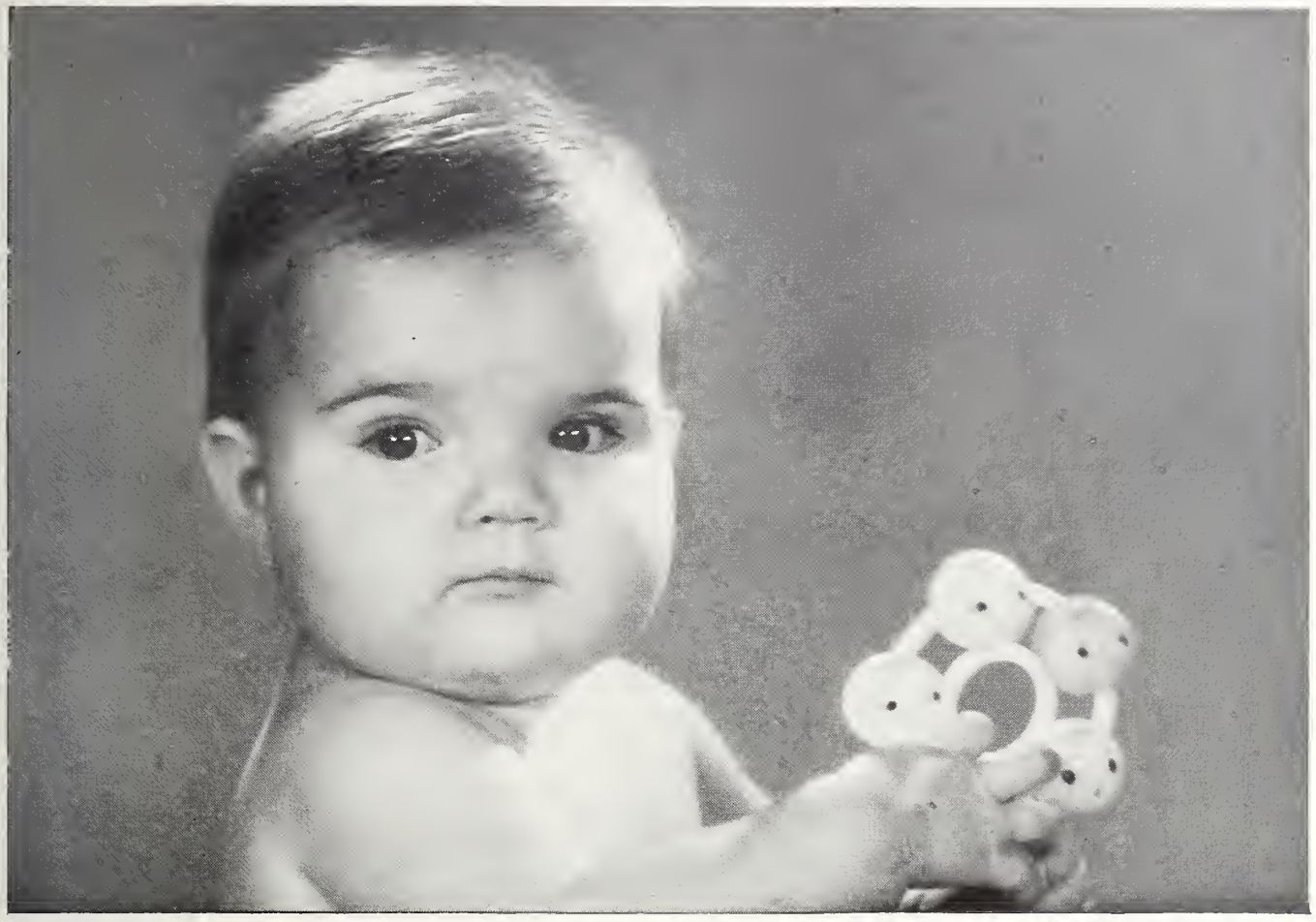
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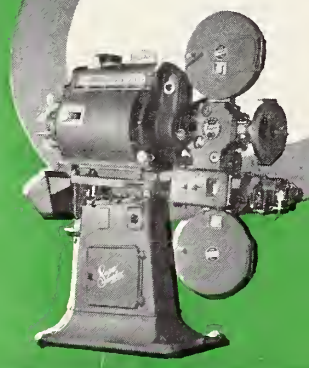
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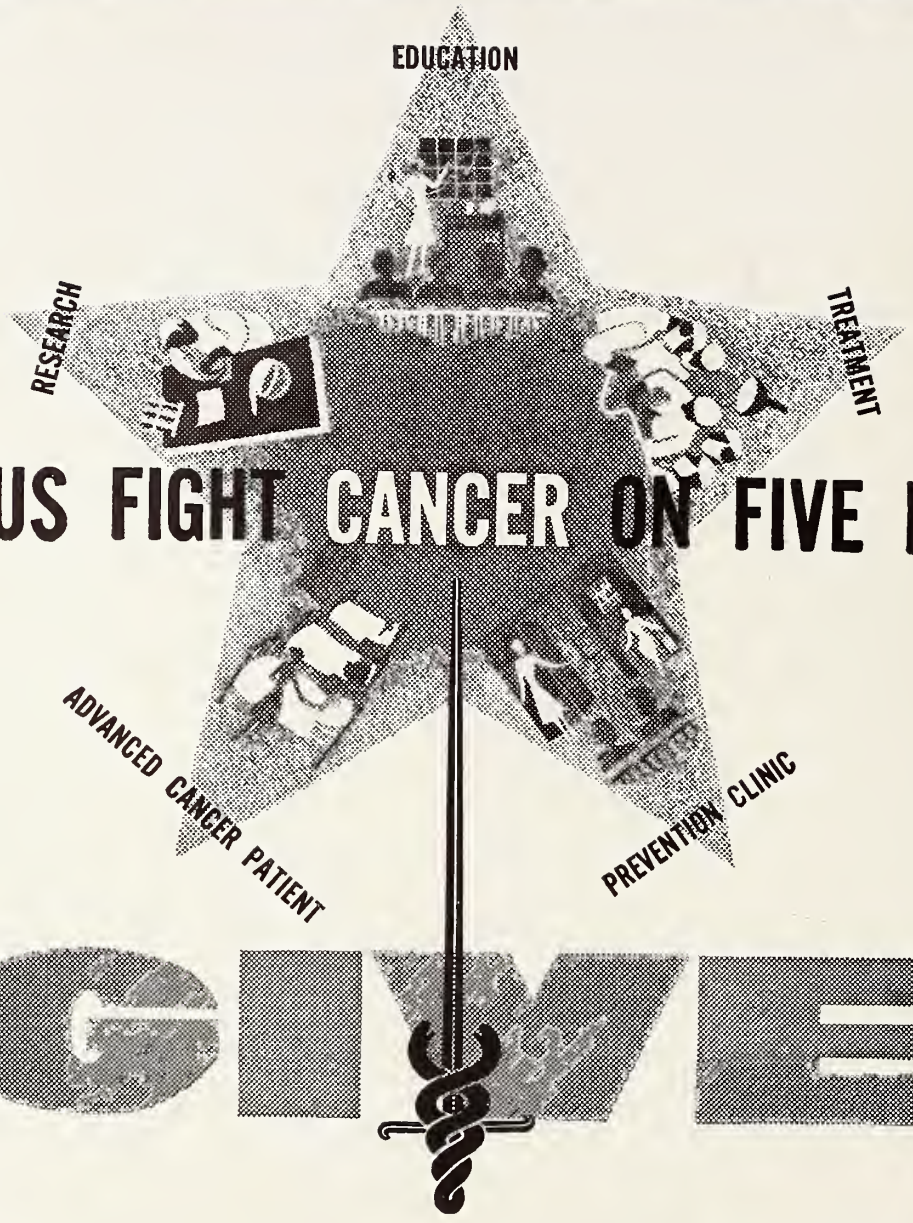


APRIL 1945

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W. L. Lightfoot, *Associate Editor*

Volume 20 APRIL 1945 *Number* 4

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Monthly Chat

WORKED OUT at the request of the Armed Forces, a group of three standards to assure high fidelity in the sound reproduction of 16-mm motion picture films has just been completed by the American Standards Association. These standards not only are of interest to the armed forces, of course, but are of wide interest to the industry-at-large. Of particular importance to projectionists are these standards at this time, due to the greater post-war field that will open up in the narrow-gauge film. The three new standards constitute part of the work done by the War Committee on Photography and Cinematography of the American Standards Association, and are detailed fully elsewhere in this issue.

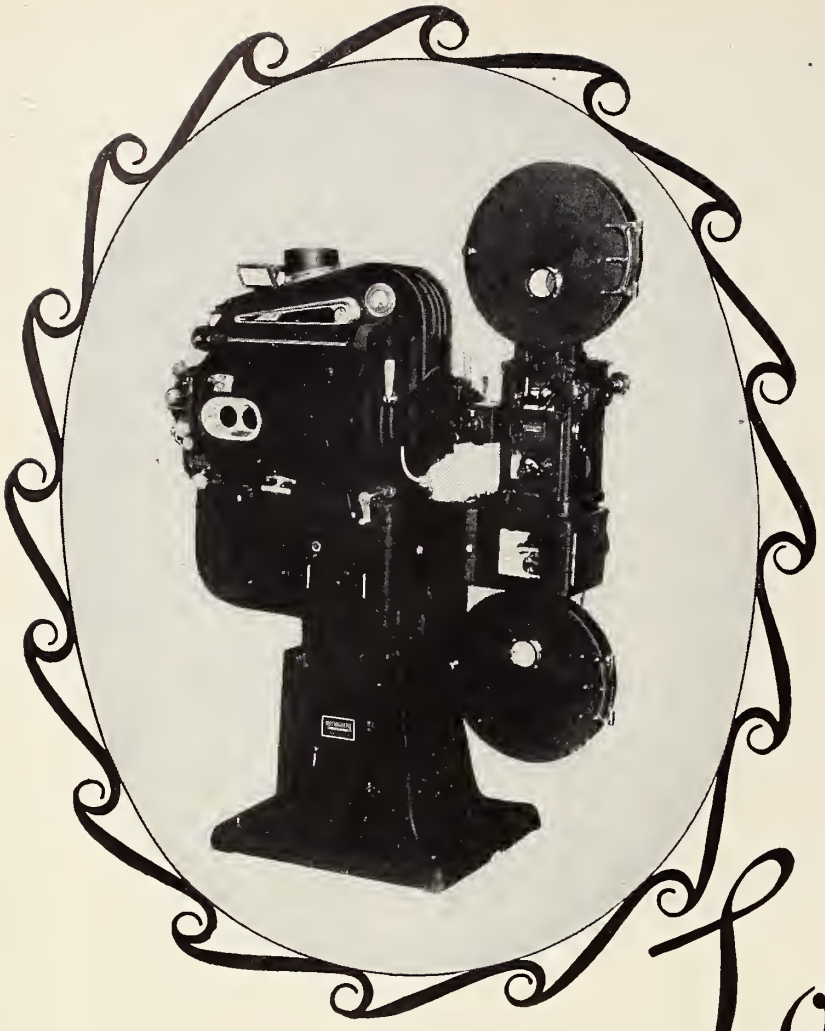
The article on Standard Tests for Motion Picture Sound Quality, prepared by Mr. Keith, covers the three new American War Standards in this field which recently were approved by the American Standards Association. Mr. Keith is chairman, Sub-group on Distortion and Signal-to-Noise Ratio of Subcommittee B on 16-mm Sound, ASA War Committee on Photography and Cinematography.

• • •

The series of articles inaugurated in I. P. last month covering the operation and maintenance of 16-mm projectors already has proved one of the most popular features ever published, with considerable correspondence resulting. Both projectionists and equipment producers have shown their appreciation of this educational work, for it is widely realized that the 16-mm field will open up considerably after the war for professional projectionists who, while versed in the operation of 35-mm projectors, as a rule have only cursory knowledge of the 16-mm equipment. Aaron Nadell, editor-on-leave, author of the article, is now preparing others, with an additional installment to appear in an early issue. Caution again is offered to keep your files intact as paper restrictions strictly limit the number of copies of I. P. that may be printed each month.

• • •

The Board of Education of the City of New York has done and is doing excellent work in the training of projectionists in the theory and practice of television. Its efforts and success should mark similar programs in other educational circles. In this issue is an article outlining the progress of the Department's efforts upon the completion of the first eighteen months' course by members of I. A. Local No. 306, in New York. We believe that other locals can and must press for such assistance from their local educational boards. Knowledge of television, both in theory and practice, will be highly essential for projectionists after the war, and the cooperative effort of the New York local and the Board of Education points the way to an expansion throughout the country of this very necessary training.



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VOLUME XX APRIL 1945 NUMBER 4

Step-By-Step Analysis of a 16-mm Amplifier

By *AARON NADELL*

Increased and extensive projectionist interest in 16-mm equipment was recognized in a recent issue of IP with a fully illustrated account of the construction, operation and maintenance of one popular 16-mm model, the DeVry RS. Herewith is presented a complete, step-by-step analysis of the schematic diagram of the amplifier associated with that equipment.

THE AMPLIFIER diagrammed in Figure 1 is part of a 16-mm system which, like most 16-mm equipment, is essentially of portable construction. In use the component parts are inter-connected by means of cables equipped with suitable plugs. A special point of interest about this circuit, therefore, is the six-point jack shown in the extreme lower right-hand corner. On this jack, points 1 and 2 supply voice current to the speaker or speakers when the proper six-prong plug is inserted; points 3 and 4 supply field excitation. It will be noted that points 1 and 3 are jumped together, therefore only a 3-conductor cable need be run to the speaker, instead of one with 4 conductors. The power supply circuit of this amplifier (the rectifier-filter circuit) will be open until the six prong plug is inserted in the jack, jumping points 5 and 6 of the jack together.

These arrangements, which are not duplicated in permanent theatre installations, will be traced in greater detail below as the circuits are analyzed.

Another point which may well be glanced at in advance of more complete inspection of the wiring is the fact that Figure 1 shows (extreme left) two photo-cells, permanently connected. This is an abbreviation, the actual arrangement is different. Either one or two photo-cells may be plugged into this amplifier; so also may up to two microphones and one record player be plugged in. Jacks for the record player and microphones are shown along the left of the drawing, which would be slightly more accurate if it showed jacks for PEC connections also instead of the PEC's in place. Omission of the jacks from the diagram, however, made for additional clarity by leaving no doubt as to the proper polarity of the cell connections.

Power Circuits

Line power enters this amplifier (through a cord and plug) at lower left, and passes rightward through a switch and fuse to the primary of the power transformer, T-4. The primary is tapped in the usual way to compensate for line voltage variations. Although in this drawing the tap connection is shown set for 120 volts, the amplifier usually will be found to have been adjusted for a voltage of 115. The line fuse is mounted on the front of the panel for maximum accessibility.

The left-hand secondary of the power transformer is center-tapped to what will be called the ground bus of this amplifier. The terminals marked X,X supply the cathodes of all the amplifying tubes, and also supply the pilot bulb filament.

The middle secondary provides plate power. Its outer terminals connect to the two plates of the full-wave rectifier tube. Its center-tap connection may be traced right, down, and right to terminal No. 5 of the six-point jack. With the proper plug inserted the connection continues through terminal No. 6 of that jack, left, up to a junction point, right through 200 ohms, and up to junction with the ground bus. It is obvious, therefore, that the ground return of the plate power circuits of this amplifier will be open as long as the plug is not in place in the six-point jack.

The "ground bus," to which two connections have already been traced, may be followed from terminals Nos. 1 and 3 of the six-point jack right, up, left to a junction point just under the lower 6L6 tube, up slightly, and left all the way across the drawing to a T junction. From this T trace downward, past the cathode of one photo-cell, and right and up to the shell of one microphone jack. Returning to the T junction, trace upward past 500,000 ohms, past 0.1 mfd, past the cathode of the other photo-

cell, and right and up to the shell of the other microphone jack.

From that jack body continue to trace right, up a trifle, right and up to the shell of the phono (or radio turner) input jack.

This ground bus, as already noted, is connmected with the center-tap of the plate supply secondary of the power transformer whenever the six point plug is in place.

Therefore, in following the various d. c. power circuits of this amplifier, it will not be necessary to trace their return lines any further than to this ground bus. From there the return continues through the six-point jack terminals Nos. 5 and 6 to the negative power terminal—the plate secondary winding's center tap.

The positive source terminal of the d. c. power circuits is, of course, the connection to the right-hand leg of the filament supply of the 5X4G rectifier tube; it will be seen just above the right-hand secondary of the power transformer, which secondary lights that filament.

D.C. Power Lines

One power circuit can readily be traced from this positive terminal—under the right-hand filament of the rectifier tubes straight right, through the filter choke coil, through 1,000 ohms, through 2,500 ohms, right and down to terminal No. 4. Thence out through the cable connection to the field or fields of the speaker or speakers, and back in at terminals Nos. 1 and 3, which constitute one end of the ground bus.

A second circuit can be traced similarly through the choke coil and then up, right, up and right to the center-tap of the primary of the output transformer. Thence trace up and down to that transformer to the plates of the two 6L6 tubes. From the cathodes of those tubes trace the return directly down to the ground bus. It will be noted that no grid bias resistor is included in cathode return line. The grid bias arrangement will be examined a little later on.

Returning again to the d. c. or rectified positive source in the right-hand leg of the rectifier tube filament line, trace right through the choke coil, right through 1,000 ohms, thence up to a four-way junction and right and up to the screen grids of the two 6L6's. The screens are therefore less positive than the plates of those tubes, to the extent of a voltage drop through 1,000 ohms. The difference is 80 volts—and so how many milliamps flow through that 1,000 ohm resistor?

Again tracing from the positive d. c. source right through the choke, through 1,000 ohms and up to the four-way junction, follow left this time through 10,000 ohms and up to a point just below the fused primary of the coupling transformer, thence left and up through a 25,000 ohm plate resistor to the linked plates of the 6N7 driver tube. The return is from cathode down through a 1,000 ohm grid bias resistor to the grounded bus.

The Positive Bus

The remainder of the d. c. circuits can be traced most conveniently by first identifying a positive d. c. bus. Follow as before from the positive source right through choke and through 1,000 ohms, up, left through 10,000 ohms, up to the second junction point and left through another 10,000 ohm resistor. Now, from the left-hand end of this resistor (where a 10 mfd. filter condenser bridges across to ground) a positive bus can be traced, running left almost all the way across the drawing, then up through 500,000 ohms and left through 500,000 ohms to ground.

Tracing this line from positive to negative (which is from right to left) the first connection is one that runs upward through a plate resistor of 130,000 ohms and then left to the plate of the 6F5 tube.

The next connection to this positive bus is a four-way junction from which trace upward and downward, through

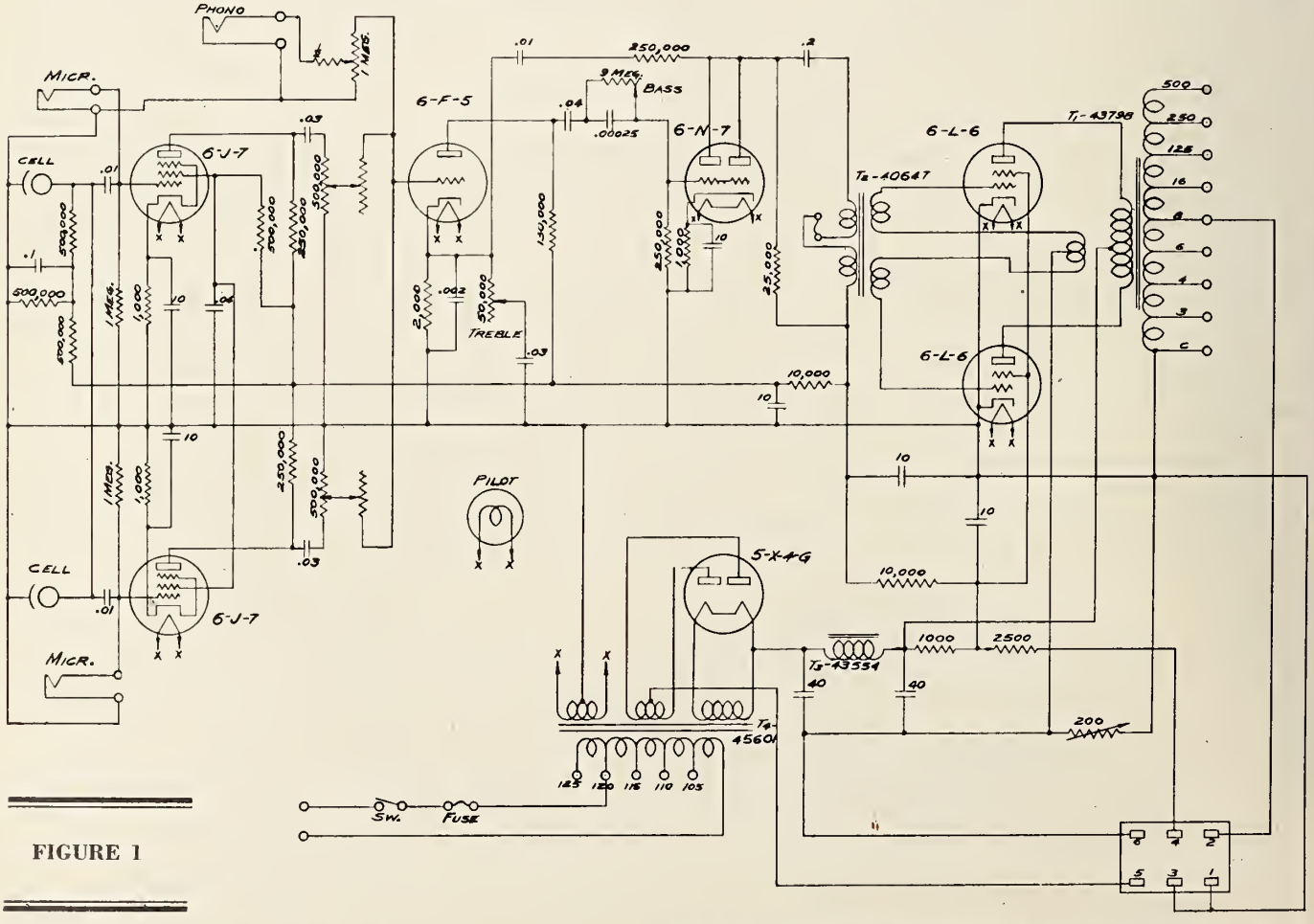


FIGURE 1

two 250.000 ohm resistors, to the plates of the two 6J7 tubes. Also from the four-way junction just mentioned trace up, left and up through 500,000 ohms to the screen grid of the upper 6J7; trace (from the same four-way junction) left, up through that same 500,000 ohms, left and then down, right a bit, and down to the screen grid of the lower 6J7.

Finally, follow the positive bus all the way left, up through 500.000 ohms, up past 0.1 mfd. and through a second 500,000 ohm resistor to a T-connection. From this T trace left to the anode of one P.E.C. and trace right, down and left to the anode of the other P.E.C.

The return circuits of the 6F5 and the two 6J7 tubes go to the ground bus through the grid bias resistors in series with their respective cathodes; the cathodes of the PEC's are of course grounded directly.

Grid Bias Circuits

Trace again the line that has here been called the ground bus from the center-tap of the middle secondary of the power transformer left down and left through the six-prong jack terminal No. 5, thence through the plug jumper to terminal No. 6, thence left, up and right through an adjustable resistor of 200 ohms. From that point onward the line that we have called the ground bus is actually elevated above ground potential by the extent of the voltage drop through those 200 ohms.

Now note that the two control grids of the 6L6 tubes are wired, through their respective halves of the secondary of the coupling transformer, to a small coil which will be further examined in a moment, and from the center-tap of that coil to the *left*-hand (or negative) side of the 200-ohm adjustable resistor. But the cathodes of the two 6L6's can be traced straight down to a four-way junction, right to another four-way junction, and then down to the *right*-hand —the positive side—side of the same 200-ohm adjustable resistor. The voltage drop through that resistor, therefore, provides grid bias for the 6L6's. This drop (which should be 25.5 volts) can be changed by adjusting the resistor; but in the absence of a very high-resistance voltmeter the adjustment had best be left alone.

The bias arrangements of the other tubes are entirely convential, and have already been noted in passing. Each cathode returns to the ground bus through its own bias resistor, the drop through which measures the bias for that tube, since each grid also returns to the ground bus through its respective grid resistor or volume control. Therefore each cathode is positive with respect to its own control grid by the extent of the voltage drop through its own bias resistor.

Speech Circuits

The speech circuits of the two 6J7 tubes being identical in every respect, only one need be traced here in detail. The upper tube will be examined: the reader may find some interest in identifying the precisely corresponding circuits for the lower tube.

Assuming the upper PEC to be the source of speech a. c., its cathode and anode would be the source terminals; the grid and cathode of the upper 6J7 would be the terminals of the load connected to this a. c. source. One side of the line runs through .01 mfd. from anode to grid. The other side of the line can be traced from the PEC cathode down through the ground bus, right to the third connection, and up through 10 mfd. to the cathode of the tube.

If the microphone jack, drawn above the photo-cell, is the source of speech a. c., trace from the upper jack terminal directly to the grid of the tube; and from the shell of the jack to ground bus and to the cathode of the tube as before.

Assuming now that the plate and cathode of that same 6J7 are the source terminals of an amplified supply of speech a. c., trace a complete circuit from the plate right through .03 mfd., down through 500,000 ohms to the ground bus, left to the second connection and up through 10 mfd to the cathode of the tube.

The 500,000 ohm resistor included in this circuit can be regarded a source of a. c. voltage drop from which excitation is drawn for the 6F5. At the same time, that 500,000 ohm acts as one part of a pad-type volume control. As much of the voltage drop as is desired is tapped off by the slider and connected, through the other side of the pad, directly to the grid of the 6F5. For the other leg of the circuit, trace from the lower end of the 500.000 ohm pad resistor down to the ground bus, right to the first connection, up, right, up through .002 mfd. and left to the 6F5 cathode.

All of the speech circuits thus far traced are reproduced identically in association with the lower 6J7 tube, the output from which also terminates, in the identical way, at the 6F5 grid and cathode.

Mixer Circuits

The 6F5, therefore, is in addition to being an amplifier, a mixer tube, in which the speech currents originating in any or all of the four separate sources thus far examined are finally mixed. It will be seen that this arrangement makes possible superimposing microphone input upon talking film reproduction.

A fifth source of speech input is at the phono jack, at the extreme top and near the left of the drawing. Speech input through this jack also terminates at grid and cathode of the 6F5. The 1 megohm volume control resistor may be regarded as the load upon the phono jack, and the voltage drop across that resistor as a fifth source of exciting voltage for the grid-cathode circuit of the mixer tube.

It will be noted that photo-cell input and microphone input can be mixed in either of the 6J7's. In other words, it is possible to play sound film through the top 6J7 and also to mix in microphone speech through that same tube. But if this is done no provision exists for modifying their relative volumes.

However, if sound film is played through the top 6J7, and microphone speech connected to the bottom microphone jack, (or vice versa) then the 500,000-ohm pad-type volume controls in the output of each tube will permit independent control of the volume of each source of sound. And if it were desired to add phono input also the volume of that input is separately controllable through the 1-meg pad resistor wired to the phono jack, and it can be added to or mixed with any or all of the other sound sources.

Tone Controls

Whichever of the above means is used to provide speech excitation for the grid and cathode circuit of the 6F5, the plate and cathode circuit of that tube can be regarded as a source of amplified speech voltage. The grid and cathode of the 6N7 tube (both halves of which are wired together as a single triode) may be regarded as the load. One leg of this circuit can be followed from the 6F5 plate right through two condensers in series and down to the 6N7 linked grids. Trace the other leg from the cathode of the 6F5 down, right, down through .002 mfd., left, down to the ground bus, right to the third connection, up, right, and up through 10 mfd to the cathode of the 6N7.

One of the two condensers in the plate-to-grid leg of this circuit is shunted by a variable resistor of 9 megohms. If the slider were all the way left the condenser would be in effect short-circuited, and would introduce no attenuation of bass frequencies—in other words, bass response would be maximum. With the slider as drawn, the bass frequencies have their choice between the impedance offered by .00025

(*Continued on page* 28)

Design of a Sound-Level Indicator†

By *H. W. HASTINGS-HODGKINS*

WHEN things go well and pictures and sound are perfect, no word of praise ever reaches the projectionist. When, however, a break occurs it may well draw caustic remarks from the patrons, if not from the management. Sound engineers, as well as projectionists, have long held the opinion that the highest form of praise is *lack* of comment; if the "sound" is mentioned at all it usually is an unfavorable mention. This is as it should be, since in the reproductive art of the kinema, the creaking of the machinery must not be heard.

Apart from film breaks and the actual failure of apparatus, the loudest "creaks" are those made by poor arc control and improper—or non-existent—monitoring of the sound level. The positive "shriek" given by a bad changeover will not receive mention here since it is assumed that the readers would not be guilty of such a sin.

At one time "sound managers" were delegated to watch over the progress of the then new kinema sound technique. These gentlemen usually managed to get into the chief projectionists' hair to such an extent that the results did not justify the expense. Whether or not sound managers are considered an economic proposition does not arise in these days of short staff, but there is little doubt that someone should be constantly on the watch to monitor the show from the auditorium.

It is perfectly true that some auditoria are so well corrected that it suffices to maintain sound level by the aid of the monitor speaker only, whereas others are more tricky. In such instances, variations in audience density, air humidity, etc., need to be watched.

The general rule in sound monitoring is, naturally, "more patrons, more sound," but sound should be used sparingly. The manager who kept buzzing the fader down to save on the electricity bill, was, no doubt, a comic figure; but he was right acoustically, if not economically.

There is the school of thought which maintains that the audience should be on such a light ration of sound that individually they lean forward in their seats with a look of intense concentration. This is going a bit too far; after all, they came in to enjoy themselves. The customer is not always right, nevertheless, when he asks you to "put it up a bit." It often happens that he cannot hear distinctly because of excessive reverberation (or echo) in the auditorium. In this case, reduce his ration and all will be well.

An Automatic Indicator

Other considerations in sound monitoring are those which arise from the recording and subject matter of the copy. Sound cue sheets are sometimes used and they are very useful to ensure that the end of a good gag is not lost through the audience laughter beating the sound level. They are not so necessary as formerly for copy level corrections as modern stuff generally gives a fairly close level from part to part. There should be no machine level correction to make by fader if the equipment has been properly maintained. If not, every effort should be made to have the soundheads levelled up as nothing is worse than a big jump in level on the changeover.

In a recent address to the British Kinema Society, President A. G. D. West outlined the possible advances in sound kinema technique. Among the wonders to come were automatic sound and light control, and there is little doubt that both of these are desirable. Few details are available as to what equipment manufacturers have developed in this respect, but it is possible to give a description of one interesting device.

"This is a "Sound Level and Reflection Percentage Indicator," which would be installed in the projection room and would indicate to the projectionists the actual conditions in the auditorium. In other words, an automatic "sound manager."

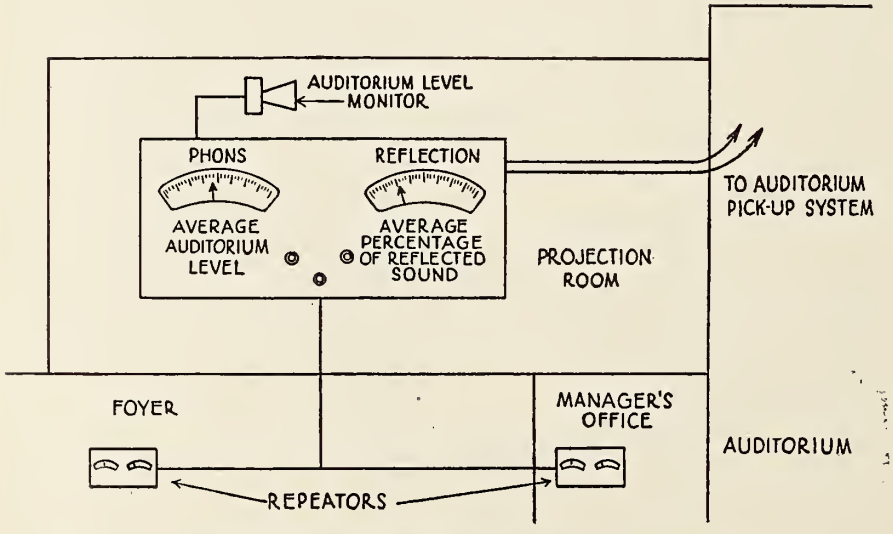
In addition to giving the average auditorium sound level in phons, this device will indicate when the reflection percentage has risen above that tolerable for definition of speech, thus advising the projectionist that he should reduce his fader setting. Repeaters can be installed in the foyer and manager's office.

As will be seen from the sketch, there would be two meters, one giving average auditorium sound levels in phons, and the other the percentage of reflected sound as against direct sound. In operation the phonmeter would be maintained at an optimum level by manual control of the sound system fader.

Slow variations in the reflection percentage would also be noted and, if rising to an excessive amount, would be checked by a reduction in amplifier gain. Any sudden surges on the reflection meter would indicate audience reactions (*i.e.*, laughter, etc.), and could be used as a fader cue to put the gag over. Meanwhile, the manager would have the status of the sound constantly under his eye.

With a device of this kind, auditoria need not be so heavily damped with sound absorbent materials—such damping is undesirable for the reproduction of music—as level corrections called for by variations in audience density can be accurately made. In fact, if the auditorium be "live" enough the manager's repeater might, by reflection percentage, give him an idea of how many empty seats he has!

† *Ideal Kinema*, Jan. 18, 1945.



Sound level and reflection percentage indicator.

ALTEC NAMES SUPERVISORS

F. Bruce Mewborn and L. K. Brisbin have been named supervisors in Seattle and Portland, respectively, H. M. Bessey, vice-president of Altec Service Corporation, announces. They are under the direction of W. E. Gregory, Seattle district manager.

W. E. DECLARES DIVIDEND

Western Electric has declared a dividend of 50 cents per share on its common stock, payable on March 30, 1945, to stock of record at the close of business on March 23, 1945.

We get to know each other better at the movies...



At a "Good-Neighbor" film showing

THE indispensable first step in getting along with a neighbor . . . across the fence or across an international boundary line . . . is to get to know each other better.

The movies are doing a lot to help the Latin Americans to know us better, and more and more films from below the Rio Grande are coming this way to help us know them better. It works both ways.

For our country's part, feature pictures, short subjects, newsreels, industrial films, agricultural films, health films . . . in English, Spanish, Portuguese . . . all are helping our neighbors to see us as we really are. At the movies, they are learning something of our culture, our history, our daily lives . . .

And in wartime, growing good will among all the American peoples has taken on new importance.

Eastman Kodak Company, Rochester, N. Y.

J. E. BRULATOUR, INC., *Distributors*
FORT LEE CHICAGO HOLLYWOOD

One of a series of advertisements by KODAK testifying to the achievements of the movies at war



AT YOUR SERVICE

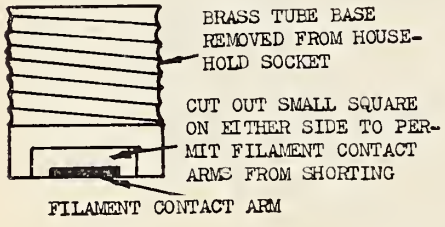
This department is a collection of random thoughts and some not so random: fact, fancy and opinion relating to the man behind the man behind the gun—the serviceman. The prime purpose of this section is to promote a closer relationship between serviceman and projectionist based on a better understanding of their mutual problems through an exchange of news and views, kinks and kicks. To this end, contributions relative to any phase of the serviceman's activities are invited.

Lubrication of 707 Drives

Partial freeze-up of 707 drives may be prevented by prompt oiling. Some projectionists operating Universal bases for the first time do not use sufficient oil on this bearing. The oil should flow on the operating side through to the bearing so that all parts of the bearing may be properly oiled.—C. S. Schwander, *RCA*.

Repairing Tube Sockets Used in Power Unit Exciter Lamp Supply

Past troubles experienced with exciter lamp supply were more or less confined to the rectifier tube socket. Much of this trouble is due to screwing the rectifier bulb too tightly into the socket, causing the brass holder inside the socket to break loose from the small screws. This



results in a direct short circuit at the filament contacts.

Where this trouble occurs, a new brass holder can be made from one of the brass holders obtained from any conventional household electric socket. Few changes are required for adapting the household sockets to the exciter lamp power supply unit. Two small squares at the base of the new brass holder must be cut away for clearance of the filament contact arm. Refer to figure below.—N. Spock, *RCA*.

Emergency Repair of Relay Solenoids

Sometime ago I suggested a method of repairing high voltage transformers. Since then I have made further inspections of transformers and open fader relay solenoids. These "opens" almost invariably occur at the point of junction between the fine wire and heavier flexible leads on the outside of the winding. Careful examination usually reveals a slight evidence of green corrosion, which is sometimes due to the flux when soldering. Over a period of several months I have been able to repair several such defective units. In making such a repair, use only the best grade of solder obtainable.—R. H. Bisbee, *RCA*.

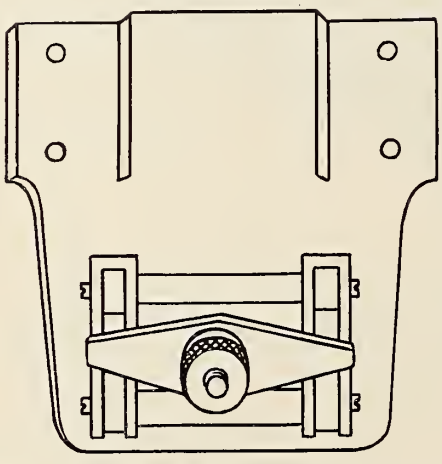
Adjusting Drive Motors on Universal Base

On some of the Universal bases there are two sets of drilled tapped holes to bolt the motor down. These holes are located about one-half inch apart. In the spare holes I put a 5/16" bolt from the bottom up. These bolts butt against the bottom of the motor. By loosening the caps or hold-down bolts and screwing the bottom bolts up, the motor can be raised to the correct height for alignment, and the cap screws can then be tightened down. This is a quick way of aligning the motor and is more accurate than shims. I adjust them until the chain coupling will run at either the 709 end or the motor end, whichever end the coupling is set to. This proves no strain and is a good alignment.—R. O'Toole, *RCA*.

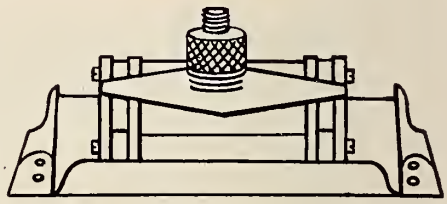
Adding Adjustable Tension On the E-3 Film Guide

A simple and effective method of obtaining adjustable tension on the E-3 film guide is shown in the accompanying diagrams. Replace present screw holding the film guide with a small ⅛" by ½" stove bolt, or similar machine screw as shown. Add a small tension spring and a knurled adjusting nut to permit adjustment. To prevent hitting the film,

TOP VIEW

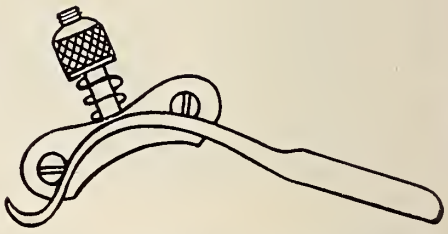


FRONT VIEW



the head of the bolt or machine screw should be filed off flat and inserted from

SIDE VIEW



the side opposite that from which the screw was removed.—N. Spock, *RCA*.

Tool for 712-A Drive

A tool for changing rawhide seal washers on W. E. 712-A drives can readily be made from a worn out pinion from the same drive. The pinion is placed in the lathe and the teeth turned down and the remainder tapered so that washers may be slid over it without damage.—R. S. Sear, *RCA*.

Correcting Noisy Volume Controls

I have found the best cure for noisy volume controls to be a product called "Grafoline" which is manufactured by the General Cement Company of Rockford, Illinois. The controls should be thoroughly cleaned and lubricated with Grafoline oil. I have been using this product for over two years and have yet to repeat the operation on any control. It is also useful on Daven attenuators, Yaxley tap switches, etc., or in any application where lubrication and good contact must go hand in hand.—C. R. Shepard, *RCA*.

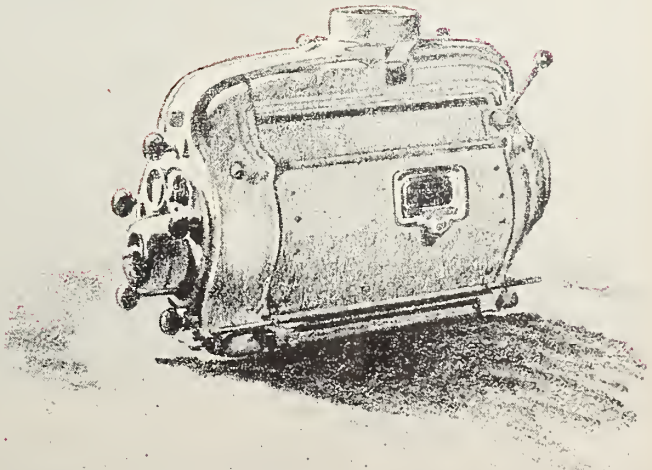
First Choice of the Majority

•

Projection Lamps by STRONG

As the only projection lamps manufactured complete within one factory, they can be so engineered as to guarantee the best screen lighting.

Strong High Intensity Lamps deliver double the light of the low intensity at an increased combined current and carbon cost of less than 2c per hour.



THE STRONG ELECTRIC CORPORATION
87 CITY PARK AVENUE
TOLEDO 2, OHIO

•

The World's Largest Manufacturer of Projection Arc Lamps

New York L. U. 306 Television Classes Hold Demonstration

CELEBRATING completion of an eighteen months course in the theory and practice of radio and television conducted under the auspices of the Board of Education of the City of New York, members of I. A. Local No. 306 recently gave a demonstration at the Radio and Maritime Trades Center in New York City. The event was held in honor of the students who had completed the course.

Included in the demonstration was a tour of the various classes being conducted for Local 306 students. The first class visited was composed of members who had completed four months training, and at the time they were engaged in constructing high fidelity amplifiers and demonstrating superheterodyne receivers completed earlier in the course.

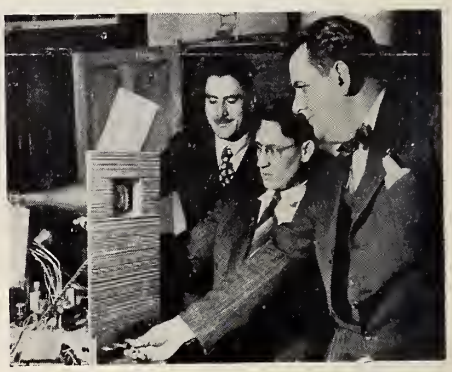
In the next class were members who had finished a twelve months training period. Their work benches held a display of electronic equipment which included remote control amplifiers, high frequency signal generators, vacuum tube voltmeters, short wave and FM receivers. The electronic devices on display were built by these students and were not only a credit to their talents but also to their teachers' guidance.

A visit to the class of graduating students was next on the program. This laboratory contained twenty television receivers, some complete in cabinets and others close to completion; a few oscillographs for saw-tooth wave checking; volt-ohmysts; Hertz antennas, and many other electronic devices necessary for the building and maintenance of television transmitters and receivers.

The Board of Education was represented by A. P. Henry, the school supervisor; Michael F. Nealie, administrator, representing George F. Pigott, Jr., associate superintendent in charge of the war industries program; and instructors Messrs. Painting, Marsh, Levene, and Berinsky. Mr. Berinsky is the author of the series of articles entitled "Projectionists' Course in Basic Radio and Television" now appearing each month in I. P.

Local 306 was represented by President Herman Gelber; Frank J. Inciardi, Educational Director, and Jack Pokalsky, member of the Educational Committee.

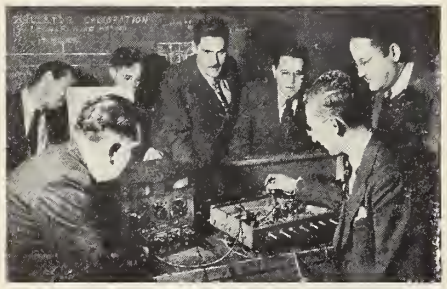
The evening's demonstration was terminated with President Gelber commending the students and the union's Educational Committee through its chairman, Frank J. Inciardi, for their excellent work and untiring efforts in preparing Local 306 members for the coming of television to motion picture theatres. He also praised the Board of Education and its personnel, pointing out that such courses would not be possible without their splendid support and cooperation.



Instructors Marsh and Painting check television receiver completed by student Louis Peltier (center).



One of the classrooms in session. Seated in the front row (left to right): Herman Gelber, president L. 306; Frank J. Inciardi, chairman L. 306 Educational Committee; and Alex Becker, student member of the local.



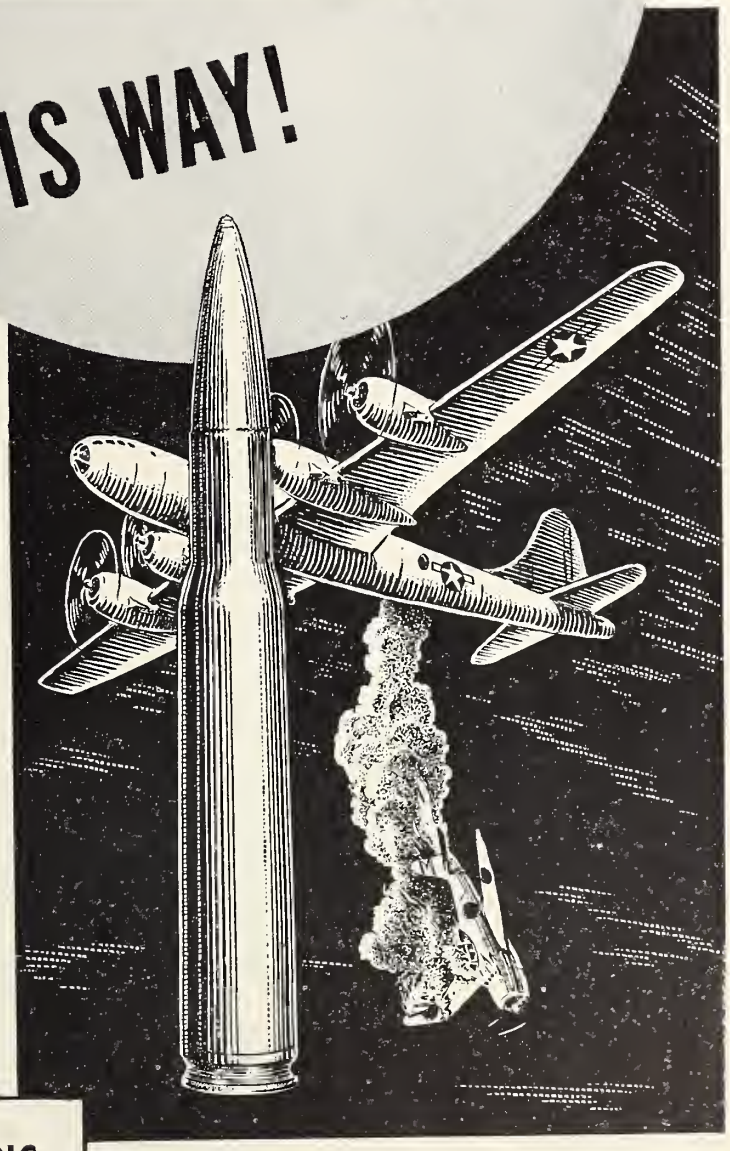
Adjusting the video frequencies of a television receiver. Front row (left to right): Instructor Painting and G. E. Kupferle. Rear (left to right): Jack Pokalsky, Louis Peltier, Instructor Marsh, M. F. Nealis, and A. P. Henry, supervisor, Radio and Maritime Trades Center.



Television and testing equipment on display in laboratory. Front row (left to right): G. E. Kupferle, Pete Christopher, members L. 306; Instructor Marsh; Frank Inciardi, chairman, L. 306 Educational Committee; Herman Gelber, president, L. 306; Jack Pokalsky, Educational Committee member; A. P. Henry, supervisor, Radio and Maritime Trades Center, and Instructor Painting, who is also assistant supervisor of the school.



THINK OF IT THIS WAY!



YOUR COUNTRY NEEDS MORE COPPER FOR AMMUNITION.

In the photograph are drops of copper from projector carbons, collected from the bottom of a lamp housing. Such collections help make possible .50 caliber machine gun cartridges . . . which can down a Jap Zero, or save a Superfortress for another bomb run across Tokyo.

When you *think of it this way* you realize the importance of collecting the copper from your projector lamps and stripping copper from old carbon stubs . . . and turning it all back into war production channels.

This you can do, through your local salvage committees or through your distributor.

Meanwhile, conserve still more copper by operating your "National" projector carbons under the recommended conditions for maximum efficiency.

NATIONAL CARBON COMPANY, INC.

Unit of Union Carbide and Carbon Corporation

UCC

General Offices: 30 East 42nd Street, New York 17, N. Y.

Division Sales Offices: Atlanta, Chicago, Dallas, Kansas City, New York, Pittsburgh, San Francisco

Keep your eye on the Infantry . . . the Doughboy does it!

The word "National" is a registered trade-mark of National Carbon Company, Inc.

IN THE SPOTLIGHT



By *HARRY SHERMAN*

ANONYMOUS mail is the plague of every editor, whether of a large metropolitan newspaper or of a small country sheet. Yours truly is no exception and the unusually large number of unsigned pieces we have received during the past few months prompts this outburst. Many months ago we mentioned our distaste for anonymous letters and once again we wish to make our position clear on this issue. We are not interested in the political affairs of any particular local union, and if a member of a local has an axe to grind or is displeased with the activities of any of his officers, he has recourse to the voting ballot. Unsigned letters sent to the offices of I. P. are promptly thrown into the wastebasket and we urge writers of such communications to remove our name from their mailing lists.

● The many friends of P. A. McGuire, director of public relations for the International Projector Corporation, will be saddened to learn that his son, Lt. Willis R. McGuire, U. S. Army Eighth Air Force, has been reported missing in action on the European front. "Mac" has been deluged with expressions of sympathy from all parts of the country, all expressing the hope that his boy will turn up safe and sound. To that we say "Amen."

● A recent visitor to the offices of I. P. was Martin Goble, member of Local No. 348, Vancouver, Canada, and petty officer photographer for the Royal Canadian Navy. Goble, at present stationed at the Halifax Naval Base, has been in service since August, 1942, having served as an electrician on a destroyer for about one year. In 1943 he was appointed one of the three men in charge of 16- and 35-mm films for the Royal Canadian Naval Film Society, a non-profit and self-sustaining organization owned by the men in the navy.



Martin Goble

Films are rented by the RCNFS to ships at sea for a nominal fee, and in remote ports the films are passed from ship to ship. One hundred and fifty ships in the RCN now provide film entertainment to their personnel, and very often the Society is able to furnish the ships with feature pictures long before they are shown in the de luxe Canadian theatres. Goble spoke enthusiastically of the reaction of the sailors to the sea-going movies, and expressed the opinion that this form of entertainment was of inestimable aid to morale.

● A fire in a New York City dry-cleaning establishment that cost the lives of two people aroused the Liberal Party in this city to the extent where it called upon the City Council to revise the existing fire and building laws. It was discovered after the fire that the store had but one exit—the front door—and witnesses to the fire said that the victims could have been saved if there had been a rear exit. At the present time there is nothing in the Administrative Code of the City of New York requiring more than one exit in street level stores.

But how about the many projection rooms in this city and throughout the country that are equipped with but one exit—NOT STREET LEVEL? Will any political party take up the cudgels for projectionists working in fire-traps, mistakenly called projection rooms, and urge that wherever necessary fire and building laws be revised so that every projection room in the country will have two exits—or are the theatre interests in this country too powerful for any political party to buck?

● Dave Hunter, member of Local No. 233, Buffalo, N. Y., and projectionist at the Buffalo Theatre, accompanied the entire Hunter family to New York to witness the presentation of the first veil to their daughter, Margaret, on April third at the Convent of Good Council, White Plains, N. Y. Bert Ryde, business agent of the Buffalo local, was also a guest at the ceremonies.

● The city authorities of Akron, Ohio, finally had to step in and order the closing of the People's Theatre because of flagrant fire violations in the projection room. The owner of the theatre, J. Mahaly, was ordered by the authorities not to reopen the theatre until a new fireproof projection room was constructed and modern projection equipment installed. Three fires in the theatre within a period of one year was just a little too much for the fire department to stomach.

● Oklahoma City Local No. 380 celebrated its 30th anniversary by throwing a bang-up party for its members and over two hundred invited guests. The party was held in the swanky Club Monroe, in downtown Oklahoma City, which was engaged that evening for the exclusive use of Local 380's party. From reports seeping into this office from various quarters, we gather that the affair was a huge success—plenty to eat and drink, grand entertainment, music and dancing. All arrangements were very capably handled by Jerry B. Jeter, Jess Bollman, and Bert Bell, the latter being business agent of Local 380 and a 25-30 Club member.

Among the invited guests were Felix Snow, International vice-president and business agent of Local No. 31, Kansas City, representing the I. A. office, and special representative Charles Hathaway, who is also the business agent for Local No. 513, Tulsa.

● Local No. 396, Binghamton, N. Y., lost one of its most loyal and progressive members in the recent sudden death of Peter A. Schoefield at the age of 51. Peter Schoefield was a member of the local for over 16 years and took an active part in the promotion of its welfare and progress. He is survived by his wife, daughter and three sons, two of whom are now serving in the Pacific theatre of war.

● Our apologies to Earle J. Ferney, member of Chicago Local No. 110, for the incorrect listing of his name last month in the caption under the photograph showing the officers and members of the local taking the radio-electronics-television course at DeForest's Training, Inc. Ferney is well known in projection circles throughout the country and was associated with Motiograph for several

years. As a matter of fact, Ferney claims to have operated the first Motiograph projector installed outside of Chicago.

● We were glad to learn that Louis R. Boyd, president of Local No. 376, Syracuse, N. Y., and chief projectionist at Loew's State Theatre, is recovering from his recent illness. One of 25-30 Club's out-of-town members, Boyd has the best wishes of all the old-timers for a speedy and complete recovery.

● Boys, its here! We refer, of course, to that old familiar refrain so dear to the hearts of our exhibitor friends—bad business, declining patronage, uncertain post-war conditions, unreasonable union demands, one step from the poorhouse, etc.—the same old tune and the same lyrics. It is now being chanted by the independent exhibitors of Minneapolis in answer to the request of the officials of Minneapolis Local No. 219 for a 5% increase, vacations with pay, and pay for preparation time for their members. These "poor mouth" gags worked very successfully in the past, we regret to say. However, we don't think the exhibitors will find our union officials quite so gullible these days—they have been stung too many times by the same bug.

● We understand that many schools, factories and clubs are planning to bid on the surplus 16-mm projection equipment now in the possession of our government. Motion pictures will be used more extensively than ever before for educational and documentary purposes, and the 16-mm field offers unlimited opportunities to the craft. Come on, boys, brush up on your knowledge of 16-mm operation.

● Gerald H. Payne, business agent of Local No. 538, Westerly, R. I., sent us an interesting letter recently informing us that IBEW is opening television schools for its members being released from military service. We are happy to report that I. A. locals throughout the United States and Canada will not be caught napping when television hits the theatres for many of them have been conducting similar classes for the past year. The craft learned its lesson well when sound hit the theatres and this time it is determined to be prepared for come what may.

25-30 Club Notes

Herman Gelber, president of New York City Local No. 306, was admitted to membership of the 25-30 Club at the last meeting. A record attendance turned out to welcome Gelber and his acceptance speech was warmly received.

• • •

"Happy Birthday" greetings were extended that same evening to P. A. McGuire (International Projector Corp.) who reached his umpty-umpth birthday. Mac neatly parried all questions regarding his exact birthdate—we would like to see the man who could best Mac in a duel of wits.

• • •

The Club lost one of its charter members in the passing of Sol Abrams, one of our most popular members. A brother, Joe Abrams, is one of the Club's trustees.

● Through the efforts of Matt Kennedy, business agent of New Haven Local No. 273, a bill protecting the well-being and safety of projectionists and patrons of motion picture theatres has been introduced. The bill—"While projecting a picture the operator shall devote his entire time and attention to that work, and shall not leave the operating side of the machine. 'Pickups,' so-called, are prohibited when only one licensed operator is employed in the booth."

It might be well for I. A. locals in the state of Connecticut to keep an eye on the legislators voting on this bill—they probably will learn which of them really are friendly to labor.

● We had an interesting chat with Louis Stoetzer, member of Washington, D. C. Local No. 224, and chairman of the Television School Committee, when he visited the offices of I. P. several weeks ago. Stoetzer, with the assistance of committee members Tom Reed, DeForest L. Ormes, DeWitt Bittenbender and Ralph Grimes, has compiled an impressive report on matters pertaining to the art of television which will be submitted to the membership at an early meeting.

● *I told you so department.* Last month we stated that Fred Kelsick, secretary of St. Louis Local No. 143, and other labor leaders of that city were backing Mayor A. P. Kaufman in his campaign for re-election to office, and that with such backing he was a sure bet to win. Well, our prediction came true and Kaufman will be the St. Louis mayor for another term.

● It is with deep regret that we report the passing of another old-timer in the craft. Leon Waldo, member of Local No. 182, Boston, Mass., for over a quarter of a century, and projectionist at the RKO Memorial Theatre in Boston, died early this month after a short illness. Waldo entered St. Elizabeth's Hospital in Boston about six weeks before his death and seemed to be well on the road to recovery when he suffered a relapse and a hurry call was sent out for blood transfusions. The esteem in which he was held by his many friends in Local 182 was borne out by their quick response to this call and although he rallied for a while after a number of transfusions, Leon Waldo died suddenly on the morning of April 4. He is survived by his wife, Hazel, to whom we offer our deepest sympathy. Waldo's many friends in the Alliance will always remember him for his sincerity and loyalty, his sympathetic understanding and unfailing kindness to his fellow men.

● Several issues ago (February) we wrote of the anti-labor activities of an organization that calls itself, ironically enough, the "Christian-American Association." We mentioned the set-back this outfit received when a United States Supreme Court decision killed a bill it sponsored in the Texas legislature which called for the registration and licensing of all labor organizers in that state.

Undaunted by this defeat, however, the CAA tried its luck in the state of Georgia, and introduced through a Rep. Lovett, a constitutional amendment outlawing the union shop. The Georgia legislature killed this proposed bill by unanimous

(*Continued on page* 25)



Chicago Local No. 110 donates $10,000 to the Red Cross. Left to right, Thos. J. Murray, chairman of labor donations, looks on as General Chairman, Martin H. Kennelly receives check from Eugene J. Atkinson, business manager and James J. Gorman, president, of Local No. 110.

Projectionists' Course on Basic Radio and Television

By *M. BERINSKY, E. E.*
MEMBER OF INSTITUTE OF RADIO ENGINEERS

X - DIRECT CURRENT MOTORS

KNOWLEDGE of electric motors is of great importance to the projectionist and to the radio serviceman. It is the purpose of this article to present some of the principles on the theory and applications of direct current motors.

The action of a direct current motor is similar to that of a direct current movable coil instrument. In the movable coil instrument the coil is prevented from making a complete revolution, but in the motor a continuous motion of the movable coil is necessary. Special means are provided so that the motion of the coil will be continuous, this being accomplished by the use of a commutator.

Principle of the Motor

A motor is a machine for converting electrical energy into mechanical energy. This action is opposite from that of the generator which is a device for converting mechanical energy into electrical energy. A direct current motor may also be used as a direct current generator.

A motor depends upon electromagnetism for its operation. As a matter of fact, the most important application of the electromagnet is found in the electric motor. Figure 1 (a) shows a magnetic field having uniform strength or intensity in which is placed a conductor that carries no current. The field is not affected by the conductor and simply goes through the copper wire in the direction indicated by the arrows.

In Figure 1 (b) the conductor is shown as carrying current toward the reader, but the field due to the north and south poles has been removed. A cylindrical magnetic field now exists about the conductor due to the current in it. The direction of this field is shown to be clockwise. This field is not distorted but exists in concentric circles because the main field has been removed.

The resultant field obtained by combining the main field and that due to the current is shown in Figure 1 (c). The field attributed to the current in the wire acts in conjunction with the main field above the conductor, but is in opposition to the main field below the conductor. The effect is to crowd the flux into the space directly above the conductor and to reduce the flux density in the region directly below the conductor. Owing to the concentration of flux above the conductor, a force acts on the conductor trying to push it down, as indicated by the arrow.

In Figure 1 (d) the current in the conductor is indicated by an arrow head. This means that it is flowing in the direction away from the reader. Under these conditions the field due to the current in the wire acts in opposition to the main field above the conductor while the same field acts in conjunction with the main field below the conductor. As shown in the illustration, the crowding of the lines of force below the conductor will tend to move it upward.

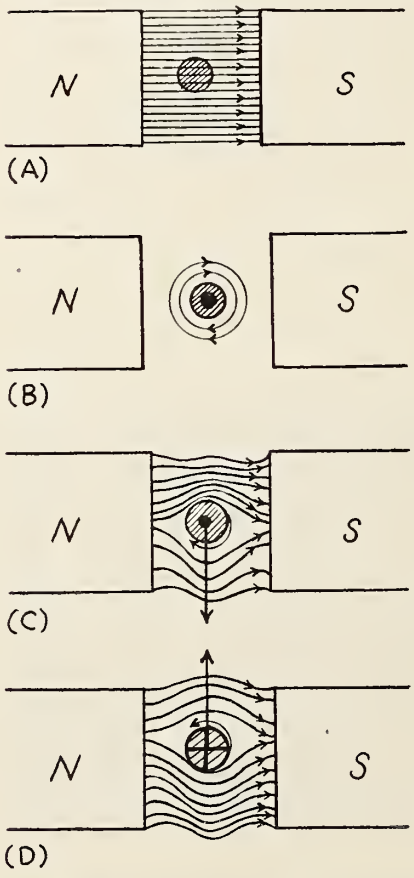


FIGURE 1. *Force acting on a conductor carrying current in a magnetic field.*

To summarize, the operation of the electric motor depends upon the principles illustrated in Figure 1. A conductor that carries a current will have a thrust exerted upon it when placed in a magnetic field. The direction of the thrust will be at right angles to the magnetic field. A definite relation exists between the direction of the magnetic field, the direction of the current through a conductor in that field, and the resulting motion of the conductor. This relation is known as "Fleming's left-hand motor rule."

Fleming's left-hand rule reads as follows: *Place the thumb, forefinger, and middlefinger of the left hand so that they are at right angles to each other. Point the forefinger in the direction of the field or flux, the middlefinger in a direction opposite to the electron flow through the conductor, and the thumb will point in the direction in which the conductor tends to move.* This rule is illustrated in Figure 2.

Another convenient method for determining this relation is to make use of the fact that the crowding of the magnetic lines behind the conductor tends to push it along, as shown in Figure 1.

Torque

When an armature or flywheel is rotating about its center, a tangential force is necessary to produce and maintain motion. This force may be developed within the machine itself, or it may be developed by external means. In a motor this force is developed within the machine; the same is true of a steam engine.

The product of this force and the radial distance from the center of the shaft to the line of action of the force is called the torque. In the English system of units, torque is expressed in pounds-feet. It is this torque which provides the turning moment for the motor.

In Figure 1 the effect of the distorted flux was shown for only one conductor. In practice, the conductor is replaced by a coil. This coil has two conductors

called coil sides. The coil is wound so that one coil side is under a north pole when the other coil side is under a south pole. The flux will be distorted in such a manner that a tendency towards rotation will exist.

Thus, if the thrust on one conductor is upward. the thrust in the other conductor will be downward. Under such conditions the coil will rotate one-half of a revolution. The coil would then come to rest because a north pole due to the coil would be placed opposite a south pole of the main field on one side of the armature, and a south pole due to the coil would be placed opposite the north pole of the main field. The magnetic field due to the coil would tend to lock with the main magnetic field. This would not provide complete motor action since only one-half of a revolution would result. In order to provide complete motor action in a direct current machine it becomes necessary to have some means of reversing the current through the movable coil (armature).

Construction of a Motor

The commutator is a device that reverses the direction of current through the armature of a motor every time that the coil moves from a north to a south pole. In a two-pole single coil motor (not practical) this reversal would take place every one-half revolution. In a four-pole motor the current would reverse every quarter turn. The commutator is made from slotted, curved sections of copper. These sections are known as commutator segments and are placed around the circumference of the motor shaft but are carefully insulated from the shaft and from each other. A soft grade of mica is used for insulation.

Figure 3 shows how the commutator is connected to the coil. If the current through the coil is traced it will be seen that its direction through the coil sides changes every half-revolution. Under these conditions the north pole due to the coil will always be near the main

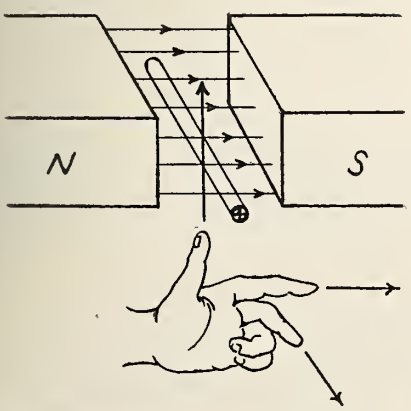


FIGURE 2. *Fleming's left-hand rule.*

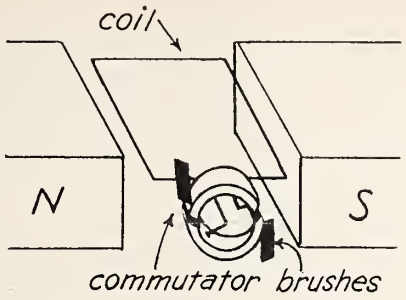


FIGURE 3. *Coil commutator segments, and brushes.*

field's north pole, and the south pole due to the coil will be near the south pole of the main field. These conditions are perfect for continuous motion because of the force of repulsion always existing between the armature and the main field.

Reference to Figure 3 shows that the current from the line is fed into the armature by a pair of carbon conductors called brushes. These brushes provide a convenient means for making an electrical connection to a rotating load. In practice the brushes are held in a housing called a brush holder. They are pressed against the commutator segments with moderate pressure, which is provided by a spring.

In a small motor the brush holder is fixed to the motor frame and the brush slides into the holder. A spring is inserted into the holder and presses against the brush providing the necessary pressure between brush and commutator. In a large motor the brush is tightly held by the holder which is mounted on a swivel. A heavy spring is attached to the holder. The other end of the spring is fastened to the motor frame, and this spring presses the holder and brush assembly toward the commutator.

The motors that have been used here for illustrative purposes have been assumed to have a single-coil armature. Such a motor would not be practical because there are times during each revolution when the coil would be rotating through a field of zero flux. The torque that such a motor would develop will be pulsating. A two-coil armature would eliminate this condition, but the torque developed would still be somewhat pulsating in character. The best results are obtained when a large number of coils is used.

In armatures of this type only a small portion of the total number of coils is undergoing commutation at any one time, therefore, the variation in the number of active conductors is so slight that the torque developed is substantially constant.

Counter Electromotive Force

The armature resistance of a 3-horsepower, 110-volt motor is about 0.5 ohms. If this armature were connected across 110 volts, the current by ohm's law would be

$$I = \frac{110}{0.5} = 220 \text{ amps.}$$

The rated current of this motor can also be found by means of Ohm's law. A 3-horsepower motor takes 2238 watts. There are 746 watts in one horsepower, therefore, 3 horsepower would equal 3 times 746 or 2238 watts. The rated current of such a motor may be found from the formula P = E x I. Solving for I. we obtain the formula

$$I = \frac{P}{E} = \frac{2238}{110} = 20 \text{ amps}$$

approximately.

Since this motor is rated at 20 amps, a current of 220 amps for the armature is not only excessive but unreasonable. When a motor is in operation, it is obvious that the current through the armature is not determined by its ohmic resistance alone. The conductors on the motor, in addition to carrying current and developing torque, are also cutting magnetic flux. Whenever a conductor cuts flux a current will be induced in the wire. This current is always in opposition to the current that the line tries to send into the armature.

Thus, the armature current is bucked out to some extent. Under normal operation the resultant current through

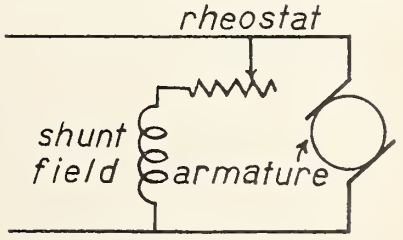


FIGURE 4. *Shunt motor.*

MARCH QUESTIONS AND CORRECT ANSWERS

1. **(Q.) Why shouldn't an ohmmeter be left on the "low-ohms" range for a long period?**
   (A.) Most ohmmeters have a battery connected directly across the meter when it is on the "low-ohm" scale, and if left in that position the battery will run down.
2. **(Q.) What type of meter is recommended?**
   (A.) A vacuum tube voltmeter is most useful.
3. **(Q.) Why isn't the d.c. wattmeter very practical?**
   (A.) The d.c. wattmeter must be used in conjunction with a separate voltmeter and ammeter, and is somewhat erratic.

the armature will approach the rated value, not the ohmic value. The voltage that results from this induced current is called the back or counter electromotive force. This counter voltage will also oppose the line voltage. The net voltage acting on the armature is equal to $E_{line} - E_{counter}$. Where I_a is the armature current and R_a is the armature resistance, the armature current by Ohm's law is

$$I_a = \frac{E_{line} - E_{counter}}{R_a}.$$

The above equation may be transposed so that the counter electromotive force can be found from values that can easily be measured:

$$E_{counter} = E_{line} - I_a R_a.$$

Shunt Motors

Motors are identified by the manner in which the field coil is connected to the armature coil. Permanent magnets are not suitable for commercial motors because of their varying characteristics, therefore field coils are commonly used for this purpose. When the field coil is connected in parallel (shunt) with the armature the motor is called a shunt motor. Figure 4 shows the hook-up diagram for a shunt motor.

The rheostat in series with the field is used for speed control. Of all the motors in use today, the shunt motor is best suited for speed control. Shunt motors usually are started at light loads. This is not due to the fact that these motors have a low starting torque, but rather because the starting boxes that are used with such motors are designed to start at light loads only and would quickly overheat under other conditions.

Shunt motors are used where constant speed is desired, and also where it is necessary to vary the speed. The rheostat is used to set the motor to the desired speed, and the speed will then remain substantially constant even if the load should vary. These motors will be found driving blowers, spinning frames, machine shop drives, *etc.*

Series Motors

In a series motor the field is connected in series with the armature. Series motors may be started with heavy loads but the speed will rapidly drop as the load is increased. The load should never be removed from a series motor. If the load were removed the field current would drop to a very low value. Under these conditions the motor has a tendency to race. The resulting speed is certain to become so great that the motor will wreck itself.

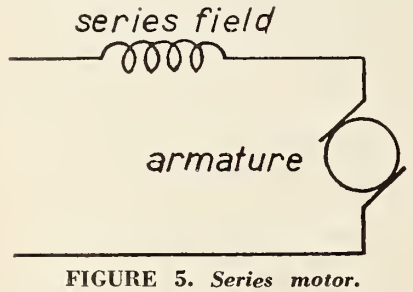


FIGURE 5. *Series motor.*

The connections of the series motor are shown in Figure 5. These motors are used where the speed or load varies over wide ranges. Such an application is found in the street car. When a street car is going uphill the speed of the series motor automatically drops. This fact is very important because it proves that the speed of the series motor decreases with increasing load and, therefore, excessive overloads are prevented.

If a shunt motor were used for street car work it would constantly be taking excessive overloads. For example, if the car were moving uphill the motor would try to run as fast as when going downhill, because shunt motors try to maintain constant speed.

Compound Motors

If a series field is added to a shunt motor it becomes a compound motor (Figure 6) and has some of the desirable features of both the shunt and the series motors. If the series winding is connected so that its magnetic field aids that of the shunt winding, the connection is called cumulative-compound.

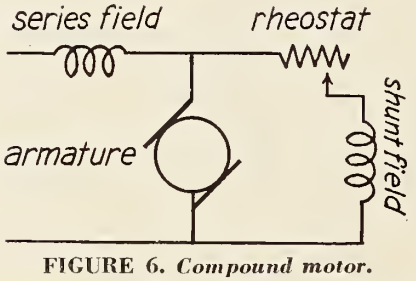


FIGURE 6. *Compound motor.*

Cumulative-compound motors have a definite no-load speed, and, therefore, do not run away when the load is removed. These motors are principally used for driving machines which are subject to sudden applications of heavy loads. Rolling mill machinery, shears, punches, cranes, and elevators use such motors.

When the series field is wound so that it opposes the shunt winding the motor is called a differential-compound motor. As the load is increased the current through the series field is increased. Since the series field opposes the shunt field the total resultant field will decrease; when the field of a motor decreases the speed increases. The speed of a differential-compound motor tends to increase with increasing loads. The diagram of a compound motor is shown in Figure 6.

S.M.P.E. CONFERENCE TO BE HELD IN HOLLYWOOD MAY 14-18

The 57th semi-annual technical conference of the Society of Motion Picture Engineers will be held at the Hollywood-Roosevelt Hotel in Hollywood, Calif., May 14-18, according to an announcement by the group. It is pointed out that members and others contemplating the presentation of papers can assist the Papers Committee by mailing complete manuscripts not later than April 20 to the West or East Coast chairmen of the Papers Committee, or to the Society's New York office.

Committee chairmen are: Pacific Coast section, H. W. Moyse; Papers, C. R. Daily; Publicity, E. O. Blackburn, West Coast, and Julius Haber, East Coast; Registration and Information, W. C. Kunzmann; Reception and Local Arrangements, Emery Huse; Luncheon and Dinner Dance, L. L. Ryder; Hotel and Transportation, C. W. Handley; Projection Programs, 35-mm, R. H. McCullough, assisted by officers and members of I. A. T. S. E., Locals 150 and 165, and 16-mm, H. W. Remershied.

Eastern and Mid-Western members who plan to attend the conference are cautioned to check railroad and Pullman accommodations, and make hotel reservations at least 30 days prior to leaving for the West Coast.

MOTIOGRAPH SALES SHOW ITS WAR WORK EXPANSION

Motiograph's manufacturing activities last year were much larger than previously, the company announces, with sales more than six times the 1941 figure. The company's three plants still are working at full capacity on production of war items and a limited amount of sound and projection equipment. A backlog of orders amounting to more than $4,500,000 is being held, not including substantial orders for sound and projection equipment for post-war delivery.

The company's post-war projector model now is going through rigid tests under actual theatre conditions, with Motiograph claiming the projector has more new innovations of design than ever has appeared on a projector mechanism, yet its design and construction is extremely simple.

FORRESTAL GETS EXECUTIVE POST WITH ANSCO DIVISION

George W. Burpee, president of General Aniline and Film Corporation, announces the appointment of James Forrestal as assistant to E. A. Williford, vice-president in charge of the Ansco Division. Mr. Forrestal, in addition to his new duties, will continue in charge of the Ansco marketing division. He joined the organization in 1933 as general sales manager.

APRIL QUESTIONS

1. **From which material is the commutator made?**
2. **Which motor is best suited for speed control?**
3. **Which type of motor may wreck itself if its load is removed?**
4. **Which type of motor is best suited for trolley cars?**

The correct answers to these questions will appear in the next issue.

Conduit Changes in The Projection Room

By *HENRY B. SELLWOOD*

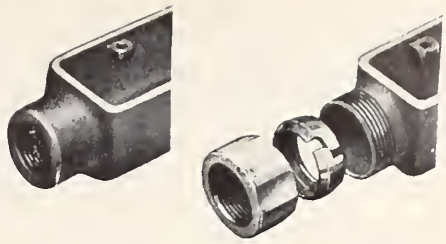


FIGURE 3

WHENEVER projection room apparatus is installed, or when any changes are made that involve alterations in conduit runs, the projectionist should be consulted. The work usually will be done by an electrical contractor with few if any ideas about special requirements of the projection room. He will introduce splices into low-level sound wiring, if nobody stops him. It will never occur to him that points of junction and accessibility should be provided to help in trouble-shooting in a hurry. There are, of course, contractors with experience in projection room work, but they are in the minority.

In some locations, where conditions permit, the projectionist may want to do the work himself and be paid for it. In every case he should approve the plans in advance—and he should be paid for studying them, and for his expert knowledge of the projection room. Some of the terminology common to electrical contractors, however, will not be familiar to all projectionists.

Figure 1 illustrates the four commonest types of conduit fittings. They are referred to as A fittings, B fittings, and so on, exactly as labeled in that illustration.

Figure 2 shows three other of the commonest types, the LB, T and X fittings.

But while these are the fittings most commonly used, and the ones that probably will meet ninety percent of all requirements, there are hundreds of others —that fact should be clearly understood. For example, the LB fitting has one conduit connection at the side opposite to the opening, — at the right of the LB illustration. If it were so constructed that the connection were made to a side adjacent to the opening—the side facing the reader—it would be an LR fitting. If it were so arranged that the connecting conduit at the right of the drawing ran straight down through the paper and through the table on which the magazine is resting, it would be an LL fitting. There are also LBB and LRB and LFT fittings and so on, almost without number. Some of these may meet some special requirement better than any one of the more usual fittings illustrated here.

If the contractor recommends any such, or if the fittings he does recommend do not seem the most perfectly suited imaginable, the projectionist should ask to see the contractor's catalogue, or obtain one of his own from an electrical supply house.

Methods Generally Used

There are two general methods of fastening conduit to the fittings, as illustrated in Figure 3. To use the fitting shown at the left of that illustration, a thread is cut on the outside of the conduit, and the conduit is threaded into the fitting. This is the type of fitting shown in Figure 2. Cutting a thread in conduit can be avoided by using the type shown at the right of Figure 3. It represents the same type illustrated in Figure 1. The end of the conduit, unthreaded, is simply slipped into the fitting, and the nut is then made up tight. The conduit is very firmly and permanently gripped. Whether threaded or threadless connections are to be made may depend in part on the type of conduit and fittings already installed.

The rectangular openings in the fittings are of course closed with suitable covers, which may be metal or porcelain, and may be solid or pierced with small openings through which wires can be led out from the conduit system. Such covers may have from one to eight holes, accommodating from one to eight wires.

The size of fitting selected depends upon the size of conduit used, and this in turn depends upon the number and size of wires to be drawn through the conduit. Underwriters' specifications govern the size of conduit to be used for every requirement, but it is always well to exceed the required conduit size, despite the additional cost. When wires are drawn through without sufficient clearance insulation may be scraped off, leading to grounding troubles in the future. Also, it may prove necessary, in connection with some future trouble, to draw a wire out of the conduit, and if there was insufficient clearance to begin with that may turn out to be very difficult, and waste a great deal of time during some future emergency. Lastly, oversize conduit will permit additional wires to be drawn in, in the future, if further changes are made, and then those changes may require very little or no additional conduit.

For flexible conduit (Greenfield) the no-thread type of fitting (Figure 1 and at the right of Figure 3) is essential unless a flexible-cable connector is added, since Greenfield can't very well be threaded. Other connectors and couplings are also available in wide variety, including "reducers" which enable any size conduit or fitting to be joined to one of different size.



A B C E

FIGURE 1 *(above)*

FIGURE 2 *(below)*



LB T X

NATIONAL FIRE CODES FOR 1945 OFF THE PRESS

"National Fire Codes for Flammable Liquids, Gases, Chemicals and Explosives, 1945," has been issued by the National Fire Protection Association, and appears at a time when war demands are for increasingly larger quantities of these materials, whose fire and explosive hazards involve great danger to human life and property.

The book assembles for the convenience of the reader the many standards dealing with these hazards. Superseding the 1943 edition, the new volume contains up-to-date information on new chemicals and solvents used in war industries, including information on their fire hazard properties and the best method of fire extinguishment. In addition there are six new or revised codes.

The price of the book is $3 per copy, and may be had from the National Fire Protection Association, 60 Batterymarch Street, Boston, Mass.

New Standard Tests for Motion Picture Sound Quality

By *C. R. KEITH*
WESTERN ELECTRIC COMPANY

ONE of the important problems of sound engineers is to devise suitable methods for measuring the quality of sound reproduced from records in order that the final result may be as nearly like the original sound as possible. A departure from ideal reproduction is termed distortion and may take various forms, such as wave-form distortion, improper frequency response, flutter, noise, and other less commonly encountered forms of distortion. The measurement of each particular type of distortion requires a special test so that it can be dealt with separately.

Because of the problems raised through the need for such tests, the Armed Forces have requested that suitable standards for the quality of sound be set up to assist them in obtaining satisfactory 16-mm prints for the training films now used so extensively in all branches of the services. Consequently, the American Standards Association War Committee on Photography and Cinematography, Z52, in cooperation with the Society of Motion Picture Engineers, has been endeavoring to set up such standards during the past year.

The first step toward providing the required tests has now been taken and methods of measurement for two forms of distortion have been agreed upon and issued as American War Standards. These are the American War Standard Method of Making Intermodulation Tests on Variable-Density 16-mm Sound Motion Picture Prints, Z52.15-1944, and the American War Standard Method of Making Cross-Modulation Tests on Variable-Area 16-mm Sound Motion Picture Prints, Z52.39-1944. These are designed to measure the particular kinds of wave-form distortion most likely to occur in sound film records of the types specified.

In addition, the American War Standard Method of Determining Signal-to-Noise Ratio of 16-mm Sound Motion Picture Prints, Z52.38-1945, has also been adopted. This method is important in the quality control of print production since improper handling during film processing will be reflected in an increase of the background noise in the sound records.

In the case of each of these forms of distortion it would have been desirable to specify limits of allowable distortion as a basis for acceptance or rejection of individual sound prints. At the present time, however, experience in the use of such tests on 16-mm prints has not been sufficient to warrant setting up definite limits. The best that could be done under the circumstances, therefore, was to agree upon the method of measurement so that the data obtained from various sources could be correlated and suitable limits specified at some later date.

In the meantime, sound recording engineers can determine by means of intermodulation and cross-modulation tests the print density which produces a minimum of distortion for a particular set of recording and processing conditions.

It may be noted that in the fifteen years and more during which sound has been recorded in connection with 35-mm motion pictures, the industry has not been able to agree upon any such limits nor have even the methods of measurement been standardized. The present American War Standards in the 16-mm field are, therefore, a step in the



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right direction even though they do not fill the need as completely as the Armed Forces would like.

The intermodulation method described in American War Standard Z52.15-1944 is used for measuring wave-form distortion on variable-density sound records which is due principally to incorrect photographic processing, including both exposure and development of negative and positive. A suitable adjustment of one of these variables, the positive exposure or density, usually is sufficient to reduce this form of distortion to a satisfactory amount.

In general, the intermodulation method of measuring distortion employs a complex wave consisting of a low frequency and a high frequency at one-fourth the amplitude of the low frequency, the combination being recorded on the sound negative and processed in a specified manner. Any wave-form distortion in the overall process causes a change in high-frequency amplitude in some portion of the low-frequency cycle. The ratio of the average variation in amplitude of the higher frequency in the reproduced wave to its original amplitude is called the intermodulation. Intermodulation test results are not directly proportional to harmonic measurements but in most cases an intermodulation figure of 10 per cent corresponds to a harmonic reading of about 2½ per cent.

The cross-modulation test is mainly for the purpose of measuring a form of distortion in variable area sound records which is caused by the spreading of the image in either positive or negative. In order to obtain proper wave form, output level, and noise reduction, it is necessary for variable area prints to have high-density contrast between the clear and exposed portions of the track.

At satisfactoritly high track densities an appreciable amount of image spread occurs, producing partial rectification of high frequencies. To compensate for this, an equal and opposite amount of image spread is introduced into the negative. Therefore, to establish the correct negative and print density combination, amplitude-modulated high frequencies are recorded and printed over a suitable density range. By measuring the rectified component from the prints, the correct density combinations are indicated.

These standards are intended to supplement the American War Standard Specification for 16-mm Motion Picture Release Prints, Z52.3-1944.

DeVRY EXECUTIVE ON TRIP

H. B. Engel, sales manager of the DeVry Corporation, is on a tour of the Southern States for the purpose of conferring with theatre equipment dealers regarding new DeVry theatre projectors and sound equipment.

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EDWARD JEROME MILLER, I. A. representative and business manager of Local No. 279, Houston, Texas, was a little shaver working as a theatre doorboy in that city when the local was formed in 1913, but he was imbued with strong union tendencies and when the projectionists went on strike in 1914 Eddie, as he is known to his thousands of friends, went out with them. In his Lord Fauntleroy suit he was added decoration to the theatre lobby, but in his street clothes while on strike it was realized that he had the stuff of which good union men are made.

Lucien M. Andler, well known as Judge Andler, who at that time was president of the local, shined up to Eddie and just a year later when he was 15, appareled in the long pants provided him by the judge, Eddie was made a member of the local, having, however, taken the precaution to let it be generally known that he was 21 years old.

Five years later, in 1920, he was elected secretary-treasurer of Local 279, and he held that post until 1923, at which time he was elected to his present office of business manager. In 1926 he was first elected delegate to the I. A. convention and he has continued to represent Local 279 at all subsequent conventions—something of a record in itself.

He was appointed an I. A. representative in 1935, a position he holds to this day. In 1936 he organized the Sixth District in Austin, Texas, and was elected its secretary-treasurer. That post, too, he has held ever since.

The War Bond record of Local 279 under the leadership of Miller is outstanding, for with a membership of 53 it has purchased $1,000 in bonds for each member, a handsome total of $53,000 to date. This is in addition to the 10% weekly bond purchases made individually by each member.

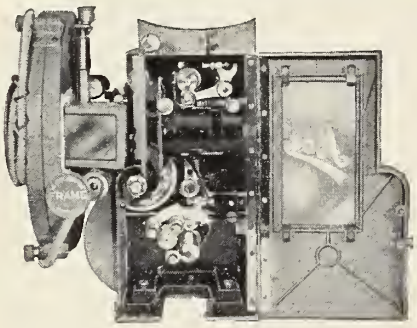
The membership of Local 279 take great pride in their meeting and club rooms and local offices, which were established under the guidance of Eddie Miller. They contend that their union headquarters are tops and are mighty proud of them.

Eddie is the proud father of Nan Grey, a shining star in the radio and movie world, and as proud a grandfather of a new female star to come, Pamela Ann Westrope. His son-in-law is the outstanding and well-known jockey, Jack Westrope.

While Brother Miller was born a Yankee in Illinois, he is a Southern gentleman by environment. The fact is highly evident to everyone who has been associated with him at one of his famous Southern dinners. Watching him recline and take a siesta after a well rounded meal is sufficient evidence to brand him as a real gentleman from the South.

He shoots a good game of golf, is a past master at gin rummy, and when it comes to betting on horses he puts "Bet a Million" Gates in the shade. He is sartorially inclined, being an immaculate dresser fond of striped ties and shirts. He drinks a little, smokes a little and plays a little. And he is always on the spot to help a friend in need.

Hats off to Eddie Miller—a swell all around guy.

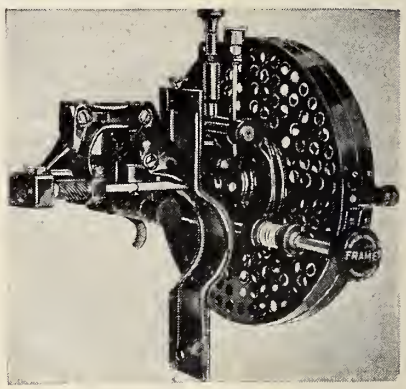


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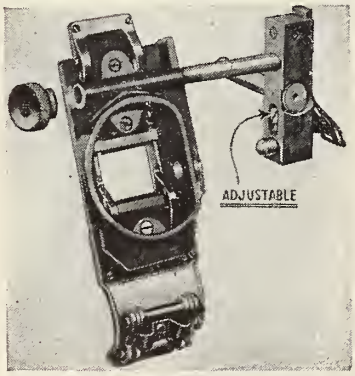
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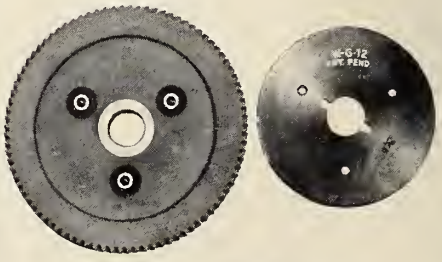
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IN THE SPOTLIGHT

(*Continued from page* 17)

vote, and the anti-labor movement of the CAA received another serious blow. Speaker Harris denounced the sponsor of the bill, Rep. Lovett, and stated that the Georgia legislature "was too enlightened to persecute organized labor."

We have been reliably informed that this labor-baiting organization is now busily engaged in laying the groundwork for its anti-union activities in South Dakota, a state where organized labor is none too strong. A report on the success of this "mission" will appear in a future issue.

● *An aside to George Murphy, secretary of Local No. 91, Boise, Idaho.* Glad you saw our point. The following item appearing in a trade publication further strengthens our argument against army-trained projectionists: "Before being turned out as a projectionist by the Canadian Army trade school, S/Sgt. Owen Gertridge, of Wolfeville, drove a truck." Our $64 question is—will Sgt. Gertridge go back to driving a truck when he returns to civilian life, or will he be another army-trained projectionist trying to compete with men who have devoted years of hard work trying to maintain high projection standards?

● Local No. 110, Chicago, reports the death of three members within one week, namely, Edward "Corkey" Smith, Fred M. George and Edward LeRoy. Our condolences to their survivors.

TBA ISSUES DATA ON FIRST ANNUAL CONFERENCE

The Television Broadcasters Association, Inc., has issued a bound volume on the proceedings of its first annual conference held in New York on Dec. 11 and 12, 1944. Copies are available at $2 each, and may be had by addressing the association at Suite 1038, 500 Fifth Avenue, New York 18, N. Y.

J. R. Poppele, president of the group, in a foreword, states that "in presenting these proceedings to the television industry we believe we are performing a real public service. The facts contained herein give a comprehensive picture of television today and its role in the post-war world tomorrow."

MODE ART PICTURES INSTALLS RCA EQUIPMENT

Mode Art Pictures, Inc., Pittsburgh, has installed a three-channel RCA scoring and re-recording system. Mode Art, whose entire output is now under contract to various government agencies, during peacetime produces industrial films and trailers. It is stated that the Pittsburgh studios had been making films without sound and having the sound dubbed in later in New York. The RCA installation will expedite production of government film, it was pointed out, and also improve Mode Art's facilities for the industrial film and trailer production which it will resume when its facilities are no longer required by the government.



...For Top-Flight Performance—

In realism of image and naturalness of sound these trouble-free, streamlined *aces of the projection booth* exceed the demands of the most critical audiences. They are built to standards far in excess of those generally accepted for motion picture sound equipment . . . Priced to enable ANY theater to afford NEW equipment . . . DeVRY *know-how* engineering, teamed with DeVRY precision methods in parts production and assembly, assures theater projection that is flicker-free, shadowless and steady as a searchlight . . . Top-flight performance for either black-and-white newsreel or technicolor feature . . . Your DeVRY *includes* a synchronized built-in Sound-Head.

DeVRY has the world's most complete peacetime line of motion picture sound equipment. Also HI-Fidelity Theater Amplifiers and Multi-Cellular Speakers. Before you buy, mail coupon to DeVRY . . .

4 Time Winner

DeVRY alone has been awarded four consecutive Army-Navy E's for Excellence in the production of Motion Picture Sound Equipment.

BUY WAR BONDS

DeVRY

New York • CHICAGO • Hollywood

DeVRY CORPORATION, Dept. IPJ-B4
1111 Armitage Ave., Chicago 14, Illinois
Please send details about the NEW DeVRY 35mm Theater Projectors...Amplifiers and Speaker Systems.

Name.....
Address.....
City.....*State*.....
Theater.....*Capacity*.....

CLAYTON BALL-BEARING EVEN TENSION TAKE-UPS

For all projectors and sound equipments

All take-ups wind film on 2, 4 and 5 inch hub reels.

Silent Chain Drives

THE CLAYTON REWINDER

For perfect rewinding on 2000-foot reels.

CLAYTON PRODUCTS CO.

31-45 Tibbett Avenue New York, N. Y.

Cleaning Aids in The Projection Room

BOTH as routine, to keep his apparatus in decent and trouble free condition, and on special occasions, as when a generator bearing threatens to "freeze", the projectionist is faced with cleaning jobs. Mechanical aids, such as brushes, rags, lens tissue and vacuum cleaner are obvious helps. Liquid or "chemical" cleaning aids are not always so well understood because they are of several types, and the right type must be used for a given job. They act primarily by dissolving the dirt, and the kind of liquid to be used depends upon the kind of dirt to be dissolved. The type of apparatus on which the cleanser is to be used must also be considered.

Classifying these "chemical" aids in the broadest possible sense, they are of three general types. One, of course, is water—hot or cold. A second consists of non-aqueous solvents—liquids that dissolve substances which water won't attack; for example, carbon tetrachloride. The third and most numerous type might be called coupling agents—something that couples water with substances that normally do not dissolve in water, enabling the water to dissolve them. A more correct but narrower term for "coupling agent" is emulsifying agent. Common soap is an emulsifying agent, but by no means the best one for all purposes.

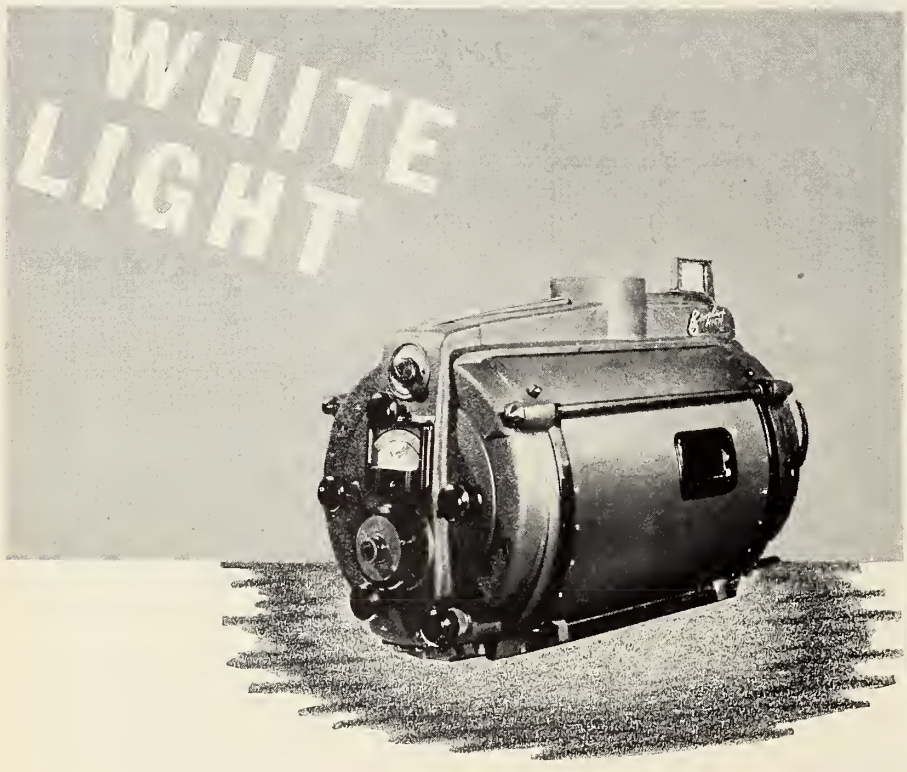
What cannot be cleaned with water—as applied, for example, with a damp rag—may perhaps be cleaned by substances of the second type named, carbon tetrachloride, for example, applied by means of a rag. In the case of a motor or generator bearing, where the lubrication has gummed and must be removed and replaced, carbon tetrachloride also is used. So is kerosene, warm or cold; and hot oil—the same lubricating oil—is very useful. Wherever oil or grease must be removed water alone can be ruled out as ineffective. Oil and water don't mix. An emulsifying agent is needed to make them mix—soapy water will remove grease that plain water won't touch. But there are also direct solvents, as stated, depending on the type of oil. In addition to those already mentioned, alcohol and acetone may prove effective.

Coupling Agents

Alcohol and acetone, although solvents in their own right, can act more or less as coupling agents—that is to say, some substance not soluble in water can often be washed away by mixtures of alcohol and water, or of acetone and water. Tri-sodium phosphate, or tetra-sodium phosphate, which can be obtained either at the drug store or from the firm that supplies the theatre's porters with cleaning materials, are highly effective on some problems. Many commercial soap powders and cleansers, obtainable at any grocery, are mixtures of these phosphates and common soap.

Hydrogen peroxide—which actually consists of about two percent peroxide and 98 percent water—acts as a coupling agent in cleaning out projector heads after film fires. The action in this case possibly is one of oxidation rather than an emulsifying action. Common lye has a very powerful action on some types of grease in still another way—it converts the grease to soap.

The practical problem confronting the projectionist, however, in his choice of cleaning agents, boils down to three simple, practical points: the agent must be effective, it must not leave any harmful



Simplex HIGH

PROJECTION ARC LAMPS

Deliver the snow-white light essential to satisfactory projection of Technicolor pictures—twice as much light as the low intensity, with but slight increase in operating cost.

IF YOU CAN QUALIFY FOR NEW EQUIPMENT WE WILL HELP YOU MAKE APPLICATION.

NATIONAL THEATRE SUPPLY
Division of National • Simplex • Bludworth, Inc.

"THERE'S A BRANCH NEAR YOU"

residue, and it must not cause corrosion.

Effectiveness can always be determined by trial and error; the other two points will require either some understanding of the actions involved or else a small bit of memorizing.

As to harmful residues: any substance which does not evaporate completely is going to leave a residue, which may or may not be harmful. Soap, unless most thoroughly flushed away, will leave a soapy film. Tri-sodium phosphate and similar detergents, unless thoroughly flushed away, will leave crystalline deposits. Hot oil used for cleaning bearings and grease cups is almost certainly going to leave an oily film behind—that is why only the same lubricating oil should be used. Kerosene is for that reason less satisfactory; some will remain to dilute the new lubricant at first. However, it is slowly volatile and in time it will all evaporate. Carbon tetrachloride will evaporate promptly.

Acetone, alcohol and carbon tet all evaporate much faster than water. They leave no residue. Water leaves none, neither does hydrogen peroxide. However, water and hydrogen peroxide are a little slow to evaporate, and they may cause some corrosion before they disappear completely.

Hydrogen peroxide has a corrosive effect on metals; this applies to water also, but to a somewhat lesser extent. Soapy water not thoroughly flushed off is particularly corrosive because any film that remains behind will be a film of water as well as soap, and the water won't dry off for a very long time. The soap will hold it in contact with the metal, keeping the metal moist, possibly for weeks.

Stirring kerosene into water, up to about one part kerosene to two parts water, reduces the possibility of the water causing corrosion of metal with which it comes into contact.

Kerosene and hot oil, alcohol, acetone and carbon tetrachloride produce no appreciable corrosion. Lye is extremely corrosive.

Acetone and even alcohol have a solvent effect on motion picture film, and should not be used, or used only with care, in cleaning film or grease. *Hot* water exercises a solvent action on the emulsion of film, tending to soften or dissolve it. Even cold water may cause the emulsion to swell after a period of time, but can be used for cleaning film with perfect safety unless the film is going to be left wet for hours.

The "organic" solvents—carbon tet, alcohol, acetone—should not be used in cleaning compound lenses. Should they be able to seep into the cement that holds the lenses together, they may dissolve it.

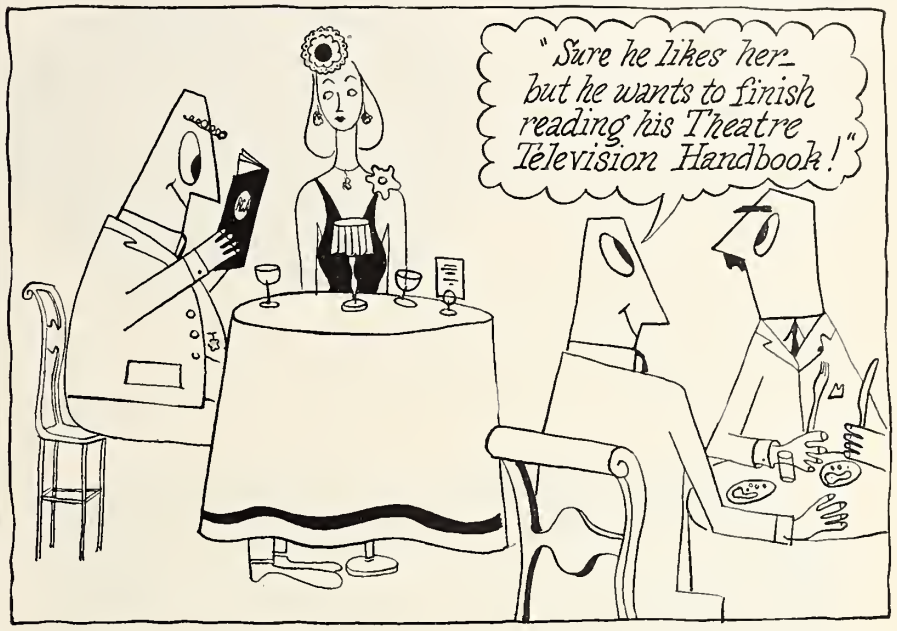
Many of the aids here named are used in commercial cleaning compounds. In order to avoid their mis-use, always apply such compounds strictly according to directions, and only for the purposes and conditions specified.

Many of these aids also can be obtained in commercial form under other names. Impure carbon tet is used in fire extinguishers; mixed with kerosene or naptha it is found in popular dry cleaning and stain removing compounds. Acetone is a component of many film cements, and is found also in nail polish remover and in varnish and lacquer removers.

H. W. FORSTER DIES

Herbert W. Forster, 47, advertising manager of Western Electric Company, died suddenly on March 30 at the Roosevelt Hospital, New York, following a heart attack. Mr. Forster lived in Rockville Centre, Long Island, and is survived by his widow and two children.

He became the company's press representative in 1930 and later as information manager conducted its information service both to the public and to employees. Articles by him have appeared in the popular, trade and technical press in this country and throughout the world. He became Western Electric advertising manager in 1940.



THOUGH you may not neglect your best girl to read your copy of the RCA Theatre Television Handbook—you will be vitally interested in learning the what, how and why of theatre television from the booklet's timely articles and discussions.

The Handbook was designed for projectionists, but also contains news of television developments of interest to exhibitors and theatre managers—such as television reception and large-screen projection. There are chapters dealing with the commercial possibilities of television, handling of programs, audience response.

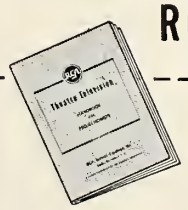
RCA'S television experience is backed by a quarter century in the field of electronics and includes television installations at the New York World's Fair in 1939, and demonstration large-screen television projection at the New Yorker Theatre in 1941. This new book is offered by the RCA Service Company as an aid to projectionists and exhibitors in preparing for the advent of theatre television.

Send for your free copy, today! Address: RCA Service Company, Inc., Box 70-177 M, Camden, New Jersey.

RCA

RCA SERVICE COMPANY, INC.

A Radio Corporation of America Subsidiary



FREE! NEW BOOK ON THEATRE TELEVISION

Don't wait—get your copy of this informative book on Theatre Television right away. No obligation.

RCA SERVICE COMPANY, Inc., Box 70-177 M, Camden, N. J.

Name.....

Theatre.....

Are you: Manager?.....Projectionist?.....

Address.....

City.....State.....

70-6436-177

16-MM AMPLIFIERS

(*Continued from page 9*)

mfd. and the resistance offered by 9 megohms. Bass attenuation is therefore maximum, whereas the higher frequencies do not find that the .00025 condenser offers so much impedance to them.

Plate and cathode of the 6N7 being regarded as a source of amplified speech a. c., a complete circuit can readily be traced right through 0.2 mfd., down through the fused primary of the coupling transformer to the third junction point, thence right through 10 mfd. to the first junction, up, then left to the second junction and up, right, up through 10 mfd. to the 6N7 cathode.

Now, there is a "treble control" effectively in parallel with this circuit, which tends to short the higher frequencies around the primary of the coupling transformer. From the 6N7 plate trace up and left through 250,000 ohms, through .01 mfd., down to a 50,000 ohm control, thence through .03 mfd. to the ground bus and back to the 6N7 cathode as before. The lower frequencies will not be appreciably effected because of the impedance offered by .01 mfd. in series with .03 mfd., but these capacitances will short out the higher frequencies to an extent depending on the setting of the 50,000 ohm rheostat; inasmuch as this line is, for practical purposes, connected right across the primary of the coupling transformer.

Output Circuits

That primary, as the drawing shows, is fused. The fuse is of the small automobile-dashboard type, and is located inside the amplifier, on top of the chassis. Only speech a. c. flows through this fuse.

The final stage is almost a conventional push-pull circuit, but the two halves of the secondary winding of the input transformer are wired in series with a special secondary of the output transformer, through which inverse feedback is obtained. This is one of many methods of securing inverse feedback — others, as well as the general principle of inverse feedback, have been frequently described in I. P. Whatever method is used, the object is always to improve sound quality.

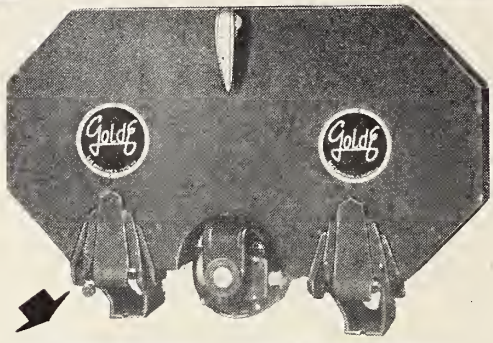
The output circuit remains essentially a standard push-pull arrangement, regardless of this introduction of inverse feedback. Considering the upper secondary of the coupling transformer as the source of speech a. c. for the upper 6L6 tube, the two legs of the circuit are: (1) from the top of that secondary to grid; (2) from the bottom of that secondary through the inverse feedback winding to the negative side of the 200-ohm adjustable resistor as previously traced, right through that resistor, up to the first junction, then left to the first junction, and up to the top 6L6 cathode. The lower 6L6 is similarly wired to lower secondary of the coupling transformer. Of course, while the grid of one tube swings positive that of the other tube swings negative, producing push-pull amplification.

Plate and cathode of the upper 6L6 may be considered source terminals for

GoldE

Model "D-H" AUTOMATIC ENCLOSED REWIND

SUPER SILENT SUPER SAFE



U. L. approved . . . eliminates fire hazard. Micro-Switch safety cut-off—when door opens, motor stops! Motor does not transmit torque to operating parts. Reel-drive Dog...prevents broken keys.

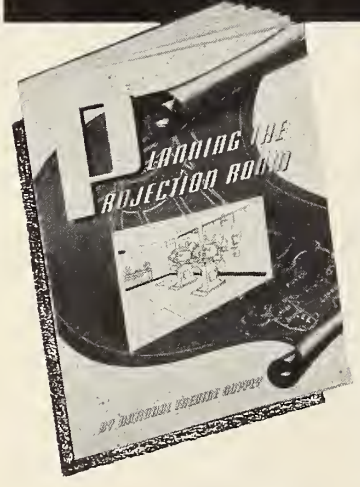
Available through Theatre Supply Dealers.

GoldE Manufacturing Co.
1220 West Madison St.
Dept. R, Chicago 7

Low Maintenance Cost • Positive Friction . . . Will Not Clinch Film

Modern, Compact Design • "Tilt-back" Case . . . Reels Can't Fly Off

Now Available TO THEATRE PLANNERS!



A NEW EDITION OF . . .

National Theatre Supply's PROJECTION ROOM PLANNING BOOK

● This book has been designed to aid Theatre Owners, Architects, Contractors and Engineers in planning postwar projection rooms which will assure greatest operating efficiency of Projection and Sound equipment in both new and remodeled theatres.

● Many new features — floor plans — wiring diagrams—illustrations of essential Projection and Sound-equipment.

YOUR COPY is waiting at your nearest National branch.

Ask for it!

NATIONAL THEATRE SUPPLY
Division of National • Simplex • Bludworth, Inc.

amplified speech current, with the upper half of the output transformer primary as the load. Trace from plate right, down through the primary to center-point, thence down and left to the right-hand side of the choke coil, down through 40 mfd., right through 200 ohms, up to the first junction, left to the first junction, and up to cathode. Plate and cathode of the lower 6L6 are wired in the same way to the lower half of the output transformer primary.

From the bottom of the secondary of the output transformer trace down to the first junction, right, down, left and up to terminal No. 1 of the six-point jack. Thence out through the speaker voice coil or voice coils, back in at terminal No. 2 of the six-point jack, and up to one of the upper taps of the output transformer secondary—whichever tap gives the best impedance match to the speaker arrangement used. A choice of eight output impedances, ranging from three to 500 ohms, is available.

GENERAL PRECISION EQUIPMENT NETS $1,138,147

The General Precision Equipment Corporation reports consolidated net income for 1944 at $1,138,147, after Federal income taxes in the amount of $2,616,700, equivalent to approximately $1.94 per share, as compared with $2.14 for the 1943 year. Dividends of $1 per share were paid by the corporation during the year, amounting to $585,954, and the net addition to consolidated earned surplus was $552,192.57.

Included in the stated income are dividends received by the corporation upon its investments in common stock of 20th Century-Fox Film Corporation which amounted for the year to $327,950, as against $371,200 in 1943. During the year the corporation sold 35,600 shares of 20th Century-Fox Film Corporation common stock at a net average price of approximately $25 per share. Funds received from this transaction were applied toward acquisition of new subsidiaries.

The volume of manufacturing activities increased during the year, and the merchandising of theatre equipment and supplies continued at a larger volume than anticipated. Net sales of all subsidiaries for the year amounted to $24,096,904, as against $20,964,525 in 1943.

RCA VICTOR NAMES JULIUS HABER ASSISTANT AD DIRECTOR

Julius Haber has been appointed assistant director of advertising and sales promotion by the RCA Victor Division of the Radio Corporation of America, Charles B. Brown, advertising director, announced. Mr. Brown also announced the appointment of Harold D. Desfor as publicity director of the RCA Victor Division.

Mr. Haber, since joining RCA in 1923, has handled publicity and special advertising promotions for most of RCA's varied activities. In 1930 he joined Lord & Thomas in New York to organize and direct publicity for RCA and Victor and other clients, but a year later he rejoined the consolidated RCA Victor organization in Camden, N. J. Mr. Desfor joined the publicity department in 1941, and for the last two years has been assistant director of the department.

D'ARCY APPOINTED CHIEF ENGINEER FOR DeVRY

E. W. D'Arcy has been named chief engineer of the DeVry Corporation, according to an announcement by William C. DeVry, president of the company. Mr. D'Arcy, formerly research engineer of Essanay Film Corporation, joined DeVry in 1940 in a similar capacity, and in that post contributed materially to design and production developments in the manufacture of motion picture sound, radar navigating and gunnery training equipment for the armed forces.

BASIC ENGINEERING PRINCIPLES BEHIND THE

TransVerteR

Given a definite need . . . such as correct and properly sustained voltage at the arc . . .

Given an engineering staff capable of designing a motor generator of such superb quality as the Transverter . . .

It becomes logical that its manufacture takes place in a plant where basic engineering principles are ever in control.

In design . . . in materials used . . . in methods of production employed . . . in precision of inspection . . . step-by-step basic engineering principles, time proved, are employed.

For further details consult

NATIONAL THEATRE SUPPLY
Division of National • Simplex • Bludworth, Inc.

In Canada, General Theatre Supply Co.

THE HERTNER ELECTRIC COMPANY

12692 ELMWOOD AVENUE CLEVELAND 11, OHIO, U. S. A.

Exclusive Manufacturer of the Transverter

A GENERAL PRECISION EQUIPMENT CORPORATION SUBSIDIARY

Strong Reflectors



Gradual deterioration of projector arc lamp reflectors results in a corresponding loss in efficiency. Since the only light which can reach the screen must be reflected by the mirror, the loss in screen light is in direct proportion to the loss in mirror efficiency.

Endeavoring to make up this light loss through the use of more current represents a pure waste in the form of unwarranted power bills. Periodic mirror replacement accordingly is a good investment.

Strong precision reflectors for all types and makes of lamps are sold by independent theatre supply dealers.

The
STRONG ELECTRIC CORPORATION
Toledo 2, Ohio
WORLD'S LARGEST MAKER OF PROJECTION ARCS

SIGNO-MARKER

The accurate, neat method of placing changeover signals on film is available at your dealer, or write direct to

CLINT PHARE PRODUCTS
282 E. 214 ST. . EUCLID 19, OHIO

This is the way to
ECONOMICAL CONVERSION

STRONG
COPPER OXIDE AND TUBE TYPE RECTIFIERS



The modern means of converting A.C. to D.C. as a stable power supply for projection arc lamps.

Low original, operating and maintenance costs.

Quiet operation.

Distributed through leading independent theatre supply dealers.

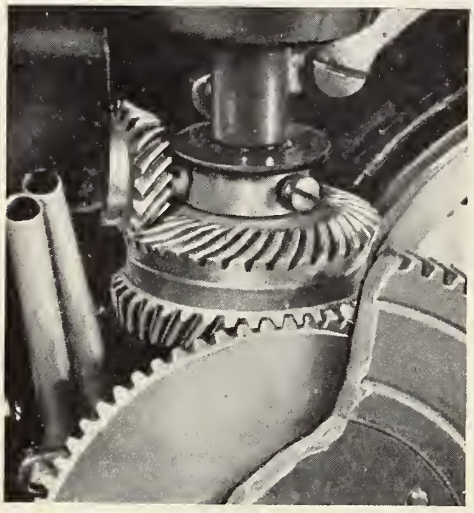
THE STRONG ELECTRIC CORP.
87 City Park Avenue
TOLEDO 2, OHIO
The World's Largest Manufacturer of Projection Arc Lamps

SPIRAL BEVEL GEARS FOR PROJECTORS

LaVezzi Machine Works of Chicago, manufacturers of motion picture projector parts, intermittent movements and assemblies, announce a new series of products in their extensive line of precision made parts.

These new LaVezzi products are precision made Spiral Bevel Gears which, it is claimed, make possible truly quiet operation and materially longer life for the parts. They differ in appearance from standard bevel gears in two respects—the teeth of spirals are oblique and they are curved, a feature which makes them stronger, smoother and more quiet than standard bevel gears under all operating conditions, according to the announcement.

The Spiral Bevel Gears are said to have continuous pitch-line contact. The teeth engage gradually, smoothly and quietly—instead of coming into full contact at once like straight bevel gears.



Showing formica intermediate gear cut away to illustrate the Spiral Bevel Gear.

It is further claimed for the new Spiral Bevel Gears that they run themselves in with oil, thereby eliminating need for grinding or lapping compounds and attendant time loss and trouble caused by need for cleaning out destructive emery from gears and bearings.

This new product is available at independent theatre equipment dealers.

SECOND ARMY-NAVY PRODUCTION AWARD FOR MOTIOGRAPH

Robert P. Patterson, Under Secretary of War, has written to the entire personnel of the Motiograph plant at 4431 West Lake Street, Chicago, that they again have won the Army-Navy Production Award for meritorious service on the production front. The second award places a white star on the previously awarded flag.

Fred C. Matthews, of Motiograph, states that nearly 100 per cent of the production capacity of all of the three Motiograph plants still continues to be utilized in the production of articles of war for the United States Army and Navy. Limited production of projectors and Motiograph - Mirrophonic sound systems for essential users also continues, he points out, as does production of component parts for all Motiograph products.

P. L. WATTS, RCA ENGINEER, KILLED IN ARMY PLANE CRASH

Pryor Lindsey Watts, who was an RCA theatre service engineer in the New York area previous to the war, and more recently an airborne radar specialist in the government group of the RCA Service Company, was killed in a plane crash on March 5 at the U. S. Army Air Base at Orlando, Fla. At the time Mr. Watts was preparing for an overseas assignment in connection with highly important military equipment.

With RCA since 1935, Watts was assigned to the Government Group at the beginning of the war and served in Newfoundland, the United Kingdom and Iceland, as well as at virtually all the naval stations and bases in the United States. He received many official Navy recommendations for his work.

He was a member of New York City Local 306, I. A., the Institute of Radio Engineers, the American Institute of Electrical Engineers, and the Society of Motion Picture Engineers.



NEW ALTEC AGREEMENTS

The Altec Service Corporation announces signing of the following new agreements during the month: Booth repair and replacement parts for E. M. Loew Theatres, Inc., in various locations in New England; renewals for sound and booth parts for Mark Rubinsky Theatres Circuit of Pennsylvania and Bartelstein Theatres of Chicago; sound service, repair parts and projection parts for the Walter Brackin Circuit of Alabama theatres; servicing of the Haberfeld & Flexer Circuit of theatres in various Mississippi and Tennessee locations and renewal of the agreement with the Lee Newbury Circuit, Arcadia Theatre Company, to service eleven theatres in New Jersey.

How Many?

Was this copy dog-eared when it came to you? How many men read it ahead of you?

You would receive a clean, fresh copy *if* you had a personal subscription—and you wouldn't have to wait—you would be first to read it.

Use coupon below.

INTERNATIONAL PROJECTIONIST,
19 West 44 St., New York 18, N. Y.

Enter my subscription for
☐ 1 year—12 issues—$2.00
☐ 2 years—24 issues—$3.00

Foreign and Canada: Add 50c per year.

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I. A. Elections

L. U. 173, TORONTO, CAN. (*corrected*)

A. Milligan, *pres.;* A. Kerrins, *vice-pres.;* P. Travers, *sec.;* G. Jones, *sec.-treas.;* Wm. Covert, *bus. mgr.;* J. Sturgess, H. Dobson, J. Hills and C. Wells, *executive board.*

L. U. 444, NEW KENSINGTON, PA.

William (Blackey) Bordonaro, *pres.;* William Austin, *vice-pres.;* F. P. McCoy, *rec.-sec.;* Charles Wolfe, *treas.;* Joe McClosky, *bus. agt.;* I. E. Fike, Joe Kaduk, *exec. board;* Joe Mickelic, B. Wasachlo, and Howard Wolfe, *trustees.*

BUY WAR BONDS

"Oh, she's OLD! Almost thirty!"





At twenty, thirty seems ancient.

At thirty, forty is distant middle age.

At forty, well, it'll be a long time before you're fifty.

The point is that ten years *ahead* always seems like a long time. Yet, actually it passes "before you know it" . . . and you find yourself face to face with problems, opportunities, needs, that once seemed very far in the future.

This is a good thing to remember today, when you buy War Bonds to speed the winning of the war.

In ten years—*only* ten years—those bonds will bring you back $4 for every $3 you put into them today.

Think of what that money may mean to you in 1955. An education for your children . . . a home . . . maybe even retirement to the place and the life of your heart's desire.

All this your War Bonds can mean to you . . . if you buy all you can today and hold them to maturity.

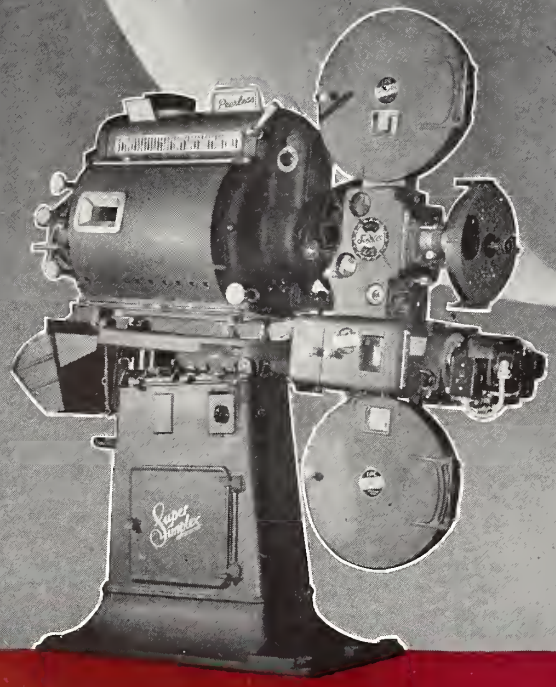
It won't be long till 1955. Not half as long as you think.

INTERNATIONAL PROJECTIONIST

This is an official U.S Treasury advertisement—prepared under auspices of Treasury Department and War Advertising Council

SCREENS AROUND THE WORLD ON THE FINEST PROJECTION AND SOUND ARE BROUGHT TO YOU BY

Simplex
REG. U.S. PAT. OFF.



Since the birth of motion pictures, exhibitors have looked to our products for leadership in projection. Tomorrow — as yesterday and today — SIMPLEX equipment will continue to prove that — BETTER PROJECTION PAYS!

Simplex
REG. U.S. PAT. OFF.

INTERNATIONAL PROJECTOR CORPORATION • 90 GOLD STREET, NEW YORK, N.Y.

Complete Sound and Visual Projection Equipment

A GENERAL PRECISION EQUIPMENT CORPORATION SUBSIDIARY

NATIONAL
THEATRE SUPPLY
Division of National • Simplex • Bludworth, Inc.

INTERNATIONAL PROJECTIONIST

JUN 11 1945





MAY 1945

VOLUME 20 • NUMBER 5

25c A COPY • $2 A YEAR

MAY 22 1945
©CLB 677809



LET'S GET THE ADMIRAL HIS HORSE!



Official
U. S. Navy Photo

Admiral Halsey has his eye on a fine white horse called Shirayuki.

Some time ago, at a press conference, he expressed the hope that one day soon he could ride it.

The chap *now* in Shirayuki's saddle is Japan's Emperor—Hirohito.

He is the ruler of as arrogant, treacherous, and vicious a bunch of would-be despots as this earth has ever seen.

The kind of arrogance shown by Tojo—who was going to dictate peace from the White House . . . remember?

Well, it's high time we finished this whole business. High time we got the Emperor off his high horse, and gave Admiral Halsey his ride.

The best way for us at home to have a hand in this clean-up is to support the 7th War Loan.

It's the biggest loan yet. It's two loans in one. Last year, by this time, you had been asked twice to buy extra bonds.

Your personal quota is big—bigger than ever before. So big you may feel you can't afford it.

But we *can* afford it—if American sons, brothers, husbands can cheerfully afford to die.

FIND YOUR QUOTA . . . AND MAKE IT!		
IF YOUR AVERAGE WAGE PER MONTH IS:	YOUR PERSONAL WAR BOND QUOTA IS: (CASH VALUE)	MATURITY VALUE OF 7TH WAR LOAN BONDS BOUGHT
$250	$187.50	$250
225-250	150.00	200
210-225	131.25	175
200-210	112.50	150
180-200	93.75	125
140-180	75.00	100
100-140	37.50	50
Under $100	18.75	25

ALL OUT FOR THE MIGHTY 7th WAR LOAN

INTERNATIONAL PROJECTIONIST

This is an official U.S. Treasury advertisement—prepared under the auspices of Treasury Department and War Advertising Council

MOTIOGRAPH

has really grown up with the movies

BORN in 1896, the year motion pictures were first shown in a regular theatre, Motiograph made its bow with the Optigraph projector. Motiograph always has been first with new developments.

In 1908, the year the Motion Picture Patents Company was formed, Motiograph offered its high grade Model "1-A" projector, attaching importance to exclusive developments.

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INTERNATIONAL PROJECTIONIST

With Which Is Combined PROJECTION ENGINEERING

W. L. Lightfoot, *Associate Editor*

Volume 20 MAY 1945 *Number* 5

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Monthly Chat

IN INAUGURATING the Seventh War Loan Drive (May 14 - June 30) Mark Van Doren, chairman of the National Book and Author War Bond Committee, in a letter to "The Stars and Stripes," said "Let's listen to the dead. Let's learn from the living." In reply, Sergeant Robert Fleisher, Stars and Stripes Mediterranean Correspondent with the Fifth Army, said that from the combat area viewpoint the war may be summed up in one sentence, as follows:

"A rifleman or a platoon leader or a commander of an infantry company in combat with the enemy has no hope of coming through the war unscathed unless he is saved by the armistice both in Europe and in Asia."

That is a potent sentence. It comes from a man on the combat line who knows what are the thoughts of those who are battling for world freedom—and for you and for me. Read that single sentence just once more before you decide on the size of your help in the new War Loan Drive. Then balance your loan—not contribution—against the life of a single man in the armed services, or even against the chance of his losing a leg or an arm, or an eye.

No matter how large your loan is going to be it never can measure up to one life, or a leg, arm or an eye.

• • •

Marked exuberance in the V-E Day celebrations was conspicuous by its practical absence, and when it was seen it generally was confined to the younger element, who all their lives had heard of the hilarity following the end of the first World War. They wanted to get in on a similar celebration at the end of the war in Europe. But there was no similarity in the celebrations. The more adult on May 7 and 8 realized that the last battle has not been fought and that the war road ahead is a terrible one, with many loved ones never to reach its end. And the younger element, out for a jollification, realized finally that they were artificially inspired by older folks' tales, and that they will have to wait for V-J Day before they can participate in a spontaneous day of modern thanksgiving. It is good for the young ones to be happy, but it also is good for them to realize that there can be no sincere celebration, individually or in mass, so long as the members of our armed forces continue to fall in other theatres of war. When V-J Day does come we can say "Amen" and then truely celebrate, each in his own way, the end of a horrid war wonderland.

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Continuation of that same brand of vision and incentive will be needed after the war. The scientist and the engineer have learned much in these last few years of accelerated war research. They possess the knowledge and the desire to have sound contribute even more to making the motion picture one of the world's greatest forms of entertainment.

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INTERNATIONAL PROJECTIONIST

VOLUME XX MAY 1945 NUMBER 5

Technical Problems of Arc Lamp Design†

By *HOWARD CRICKS, F.R.P.S.*

The author presents some of the technical problems confronting the arc lamp designer.

THE design of any arc lamp must be built around two components: the mirror and the carbons. Let us first consider the facts operating in the design and choice of the mirror.

It is a popular fallacy that the larger the mirror the greater its efficiency. Actually, of course, it is not diameter that counts, but the angle of collection from the positive crater. So that a small-diameter short-focus mirror may be equally efficient with a mirror of larger diameter but longer focus. As against this there is, of course, the factor that the shorter the focus of the mirror, and the nearer to the crater. the more it will be subjected to deterioration due to overheating. This is particularly the case when the arc is tilted for a downward projection rake, when the flame will tend to burn towards the mirror.

Another factor is that the bulk of the light from the positive crater is directed within a cone of fairly small angle. If one looks at the crater from an angle (through a dark glass, of course!) it will appear not only less bright than if looked at squarely, but also oval in shape, instead of circular. If, therefore, the collecting angle of the mirror is increased beyond a certain point, the amount of light collected will not increase proportionally.

The final factor in mirror design is the requirement of a fairly even illumination across the gate aperture. If the mirror were of spherical curvature, as was the case in the early days of the mirror arc, then it would produce a very bright spot in the center of the picture, with the edges falling off to a serious extent. The theoretically ideal curvature would be an ellipse; as shown in Figure 1. If the crater is placed at one focus of an ellipse, the light will converge towards the other focus, and if the gate is placed here. or slightly in advance of it, the light should be concentrated and even.

But a true ellipse is not only difficult to produce; it would be rather critical in operation. And, therefore, practically all mirrors in use today are of a modified form of ellipse. The one exception is the mirror used in arcs which employ a large-diameter condenser; in this case the rays of light from the mirror to the condenser should be parallel, and therefore a parabolic mirror is employed, the rays being converged to the gate solely by means of the condenser.

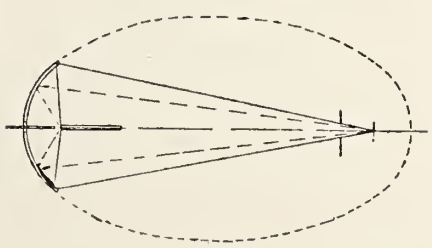


FIGURE 1. *Explanation of elliptical mirror.*

Experience shows that the most efficient mirror is of 12-in. diameter, with a working focal length of something over 4 in. A 10-in. mirror can be nearly as efficient, but a 14-in. shows little improvement over a 12-in., except possibly as a basis for salesmanship.

The choice of the mirror will determine three important factors of our arc: (1) it will indicate a minimum size for the lamphouse; (2) it will determine the dimensions of the mirror mounting and controls, and (3) its focal length will determine the distance from mirror to crater.

The second factor to be considered in the design is the characteristics of the carbons to be employed. First, is the negative carbon to be horizontal or at an angle? Second, and most obvious, the jaws must be of correct size to grip the carbons. Third, the rate of feed and—of equal importance—the *ratio* of feed between the two carbons must be suited to their respective burning rates. More generally, the whole construction of the lamp must be adequate to withstand the current at which the carbons are to burn, and the lamphouse must provide ade-

† Ideal Kinema, March, 1945.

quate ventilation for the escape of heat and fumes.

First, will the carbons burn best in line, or with the negative at an angle? Carbon experts will, I think, agree that while for smaller carbons a horizontal negative is the most efficient, as the current increases so greater efficiency will be secured if the negative carbon is dropped. Thus, in one arc I designed the negative carbon is at an angle of 15 deg. below the horizontal; at the higher current needed by the Hall and Connolly condenser arc, the angle is as much as 45 degrees.

Horizontal or Angular

This question of horizontal or angular negative has an important influence on the design of the lamp. The use of an angular negative will naturally complicate the feed adjustments to a certain extent. In addition, in operation a double focusing adjustment is needed—one adjustment to keep the positive crater at the correct distance from the mirror, and the second to ensure that the negative will then be in the correct position relative to the positive crater (Figure 2). The second is most easily assured by means of the usual separate control for the two carbons, but in one arc a single adjustment moves the two carbons simultaneously, not in opposite directions as in feeding, but in the same direction.

The jaws must obviously be capable of gripping carbons of any size intended to be used in the lamp. For an arc intended only for, say, two sizes of carbons, such as 8-mm and 7-mm positives, a plain grip is adequate; but if an arc is intended also to run low-intensity carbons, which may be as large as 14-mm in diameter, then not only must the jaw accommodate this range of sizes, but it must maintain the carbon central on the mirror axis.

Since the negative carbon has to protrude through the hole in the mirror, its holder must take the form of a chuck, mounted on a spindle which can be gripped in the rear jaw. With any carbons, but especially with small-diameter high-intensity carbons, accurate alignment of the two carbons is most important; therefore, fine adjustments must be provided for the purpose of lining the negative up with the positive, vertically and laterally.

In many arcs the feed ratio between the two carbons is fixed by the different pitches of the two feed screws. This, of course, means that any discrepancy in the burning rates—occasioned, for instance, by the use of different carbons or different currents—must be compensated by frequent hand adjustment. Actually, some form of ratio adjustment should be regarded as an essential; this may take the form of a lever of varying length through which the negative jaw is fed.

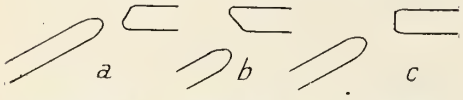


FIGURE 2. *Adjustments of angular negative carbon: (a) and (b) wrong; (c) right.*

Given some such adjustment, and assuming it is properly set, then the maintenance of a correct arc gap will depend upon the characteristics of the feed motor and the manner in which it is connected. In this connection, it is important to remember that as the gap lengthens, so the arc volts increase; this fact is made use of to control the feed rate by causing the feed device to tend to maintain the voltage constant.

In one lamp, for instance, the varying arc voltage operates relays, which cause the motor to feed intermittently. But more often the arc voltage merely controls the speed of the motor. A circuit which I have found particularly suitable is shown in Figure 3, in which the variable resistance can be adjusted to suit the burning rate of the carbons and the arc voltage at which it is desired to work.

Having given the motor speed for a given arc voltage in the central position of the variable resistance, it is a matter of simple mathematics to compute gearing of suitable ratio to feed the carbons at the correct burning rate. But obviously the success of any such mechanism will depend upon the carbons being burnt at the correct current and arc voltage.

It will be noticed that in the foregoing remarks the term arc voltage appears to play an even greater part than the current. It is of great assistance to the projectionist to have a voltmeter connected across the carbons, and the correct place for this is surely on the arc itself.

Flame Control

With high-intensity carbons some form of flame control is essential. Earlier arcs made use of a rotating positive, which keeps the crater central and circular. In my experience, however, this tends to produce too deep a crater, particularly for a mirror arc, and my preference is for magnetic control. The theory of this is too involved to discuss at the moment; but it is a fact that if a magnetic field is suitably adjusted, not only will the crater be kept stable and the flame deflected away from the mirror, but, in addition, some increase in light output can be obtained. The effect is that the magnetic field squashes the flame back into the crater, so increasing the temperature and light output. The danger is that the field may become either too strong or off center, when the flame may try to escape at one side, so ruining the crater.

Once the data on the foregoing points are established, the design of the arc becomes simply a matter of draughtsmanship. Naturally there are many practcal points to be considered: protection of the mechanism from the dust and dirt of the arc, and particularly of the motor from the heat; accessibility and convenience for cleaning; ease of recarboning; convenient location of controls; adequate electrical insulation; and the general requirements to ensure freedom from mechanical or electrical faults.

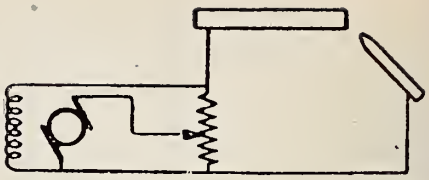


FIGURE 3. *Potentiometer type motor circuit.*

Ventilation Problems

Next we come to the lamphouse. Mechanically the chief requirement in its design is adequate and correct ventilation. The outlet vent must be in such a position that no matter at what angle the arc is inclined, the flame will tend to burn at right angles to the positive carbon, neither burning forwards and spoiling the crater, nor burning backwards and licking the mirror. The magnetic control will help materially in this respect; but the flame of a small high-intensity carbon is very susceptible to aid currents.

Other practical aspects of the lamphouse are the provision of large doors for accessibility; of a sturdy dowser to protect the mirror when the arc is struck, and of a cutoff to keep the light and heat from the projector gate; facilities for examining the crater-viewing windows on either side, and a periscope imaging the crater on a card on which the correct length of gap is indicated.

It is an unfortunate fact that many buyers of projection equipment judge by appearance rather than by technical perfection, and, therefore, the design of the lamphouse must be pleasing to the eye. Fortunately, the most efficient design is frequently also the most pleasing to the eye.

A point that must not be overlooked is the arrangements for connecting up the arc. The asbestos flexible leads from the jaws must be led to suitable terminals, to which the cables from the switchboard may be connected. Provision must also be made for connecting up the feeding motor.

Finally, there is the question of means for securing the lamphouse on the projector stand. This is a matter which hardly needs standardization, for, as many of us have learned by experience, it is quite often difficult to fit a new arc lamp to a stand adapted for another type of arc.

Providing Auxiliary Sound Requirements for Motion Picture Theatres

By *HENRY B. SELLWOOD*

In a previous article on this subject we discussed the difficulties currently facing motion picture theatres in obtaining, operating and servicing auxiliary sound equipment for both entertainment and advertising purposes. It was pointed out that a number of projectionists are increasing their incomes by making their talents and training available to theatres in this connection. The discussion is herein resumed.

FIGURE 1 shows the schematic diagram of a mobile amplifier used in a truck or automobile or in a horse-drawn wagon or carriage, for purposes of exploitation. The only power source it needs is an ordinary 6-volt storage battery—a common automobile battery.

Power input terminals are shown at the lower right hand corner of the drawing. They run through a fuse and a switch to a 6-volt dynamotor. A receptacle connected across the line makes the same six volts conveniently available for powering a d. c. loudspeaker field, or for any other purpose, such as a small string of 6-volt lamp bulbs used decoratively on the sound truck or wagon or carriage.

A dynamotor is a very special kind of motor-generator, the details of which are not shown in the drawing. An ordinary motor-generator (such as many projection rooms use for arc current supply and—in some cases—for sound system current supplies) consists of two machines. The motor and generator are individual units, one driving the other. Each contains a rotary element, the armature, and in addition each has field windings. These two units may be coupled together, or they may be mounted inside the same casing with their rotary elements built around the same shaft, but they still are two complete units.

The dynamotor does not contain two complete units. It is a kind of motor-generator in which there is a motor armature and also a generator armature, entirely distinct from each other, but there is only one field structure, and that field serves both armatures. The result is a very compact machine, and an inexpensive one, but one that is difficult to adjust as to results. The field rheostat used with ordinary motor generators does not work out well with dynamotors, because in the dynamotor one field serves two entirely different purposes.

Dynamotors in consequence are seldom controlled either as to speed or output. They are correctly chosen for the work they are to do, connected with the apparatus they are to serve, and merely switched on or off. They are seldom equipped with motor starters. In other words, they are very simple devices, but only the right dynamotor can be used for any given apparatus.

As to maintenance, they need the same care as any motor-generator. There are two separate commutators, one for each armature; they require the same looking after as any commutator. The bearings need lubrication from time to time. The projectionist is familiar with all these requirements.

Power Circuits of Figure 1

All tubes of Figure 1 have 6-volt heaters. The filament circuit, therefore, is merely a parallel connection to the six-volt storage battery, and is not shown in the drawing.

Plate power is delivered by the dynamotor, which provides high voltage d. c., hence there is no rectifier circuit in Figure 1. Also, the filter circuit is extremely simple. It consists only of the 8 mfd. condenser drawn to the left of the dynamotor, which removes the commutator ripple. The upper plate of that condenser may be regarded as the positive d. c. source for the balance of the circuit. The negative side of the d. c. line is grounded, and return to negative is through chassis or ground.

From the upper side of the condenser trace up, right and up to the primary of the output transformer—through the two halves of that winding to the plates of the 79 tubes. The cathodes of those tubes are grounded, providing the return circuit.

From the top of the condenser trace straight up, through the primary of the coupling transformer to the plate of the 89 tube. The cathode returns to negative (ground) through a 1250-ohm grid bias resistor.

From the top of the condenser up, left, and up through ½ megohm completes the connection to the plate of the 77. Similarly, follow from the top of the condenser up, left, up, left through ¼ megohm and up to the screen of the 77—which, although a pentode, is used here in tetrode connection. The ¼-meg. resistor just traced and the 25,000 ohm resistor immediately to the left of it constitute a voltage divider. The 25,000 ohms bridge the screen-cathode circuit of the tube. Trace the cathode to ground, down through 3,000 ohms and left to a ground connection.

This 3,000 ohm cathode resistor provides control grid bias for the 77, return of its negative side to grid running through two parallel paths—the 100,000 ohm volume control and the secondary winding of the input transformer.

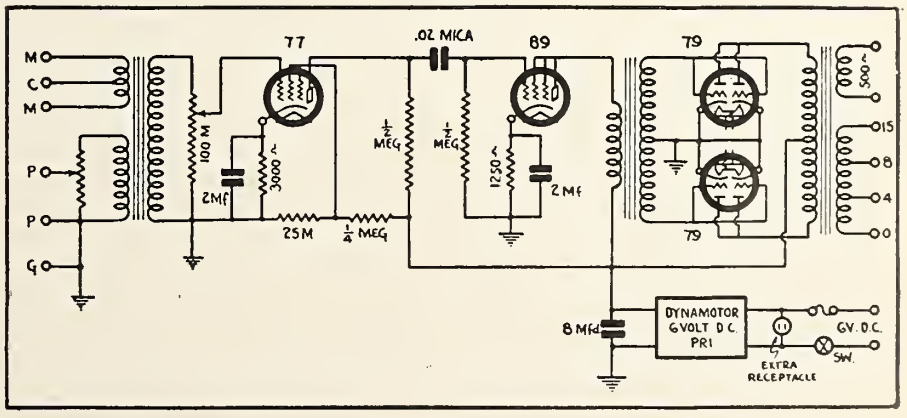
Bias for the 89 is provided by 1,250 ohms in series with the 89 cathode, and returned to grid through ½ megohm.

The 79's operate at zero grid bias. Therefore those grids swing positive during part of the input cycle, increasing output power at the cost of some distortion.

The grid bias or cathode resistors of the two voltage amplifier tubes are bypassed by 2 mfd. condensers.

Speech input enters at the left, and

FIGURE 1



may be either microphone or phonograph output. In the case of the latter, one side of the line is grounded.

The secondary of the input transformer is connected directly across the 100,000 ohms of the volume control, which thus constitutes the load upon the secondary winding. That portion of the potentiometer which is included between the slider and ground is the source of speech voltage for the 77 tube, the connection to grid being direct and to cathode running through 2 microfarads.

The speech output of that tube may be traced from plate right, down through ½ megohm, right, and down through 8 mfd. to ground, from ground up, right, and through 2 mfd. to cathode.

The ½ megohm plate resistor may be regarded as a source of voltage, one side of which connects through .02 mfd to the control grid of the 89; the other side running through ground and 2 mfd. to the cathode of that tube. The 89 is triode-connected; its screen and suppressor grids being electrically extensions of the plate.

The primary of the coupling transformer, in series with 8 mfds., constitutes the load upon the output of the 89 tube. The secondary winding of the coupling transformer supplies the source voltage driving the 79 output tubes; the voltage developed between the top of the winding and the center-tap driving the upper 79; that developed between the center-tap and the lower end of the winding being applied to the grid and cathode of the lower 79. In each of these tubes the two sections are jumped together, so that each acts not as a two-section tube, but as an enlarged simple triode. They are loaded by their respective sections of the primary of the output transformer.

The secondaries of that transformer provide speech current at a choice of impedances to match any desired loudspeaker combination.

The reader will have noted that this amplifier is far simpler than a common theatre amplifier—just as the dynamotor is simpler than an arc supply motor-generator.

There is nothing in Figure 1 that ought to give the slightest trouble to any projectionist.

Auxiliary Sound Services

A common use of auxiliary sound devices is the reinforcement of live entertainment by means of a microphone. The essentials of the system are very simple: a microphone, an amplifier, and a loudspeaker. The details may be more complex in that several speakers may be needed to cover the whole audience; other sources of sound such as a record player or radio tuner may be incorporated; there may be more than one microphone. Such additions do not compromise the basic simplicity of sound

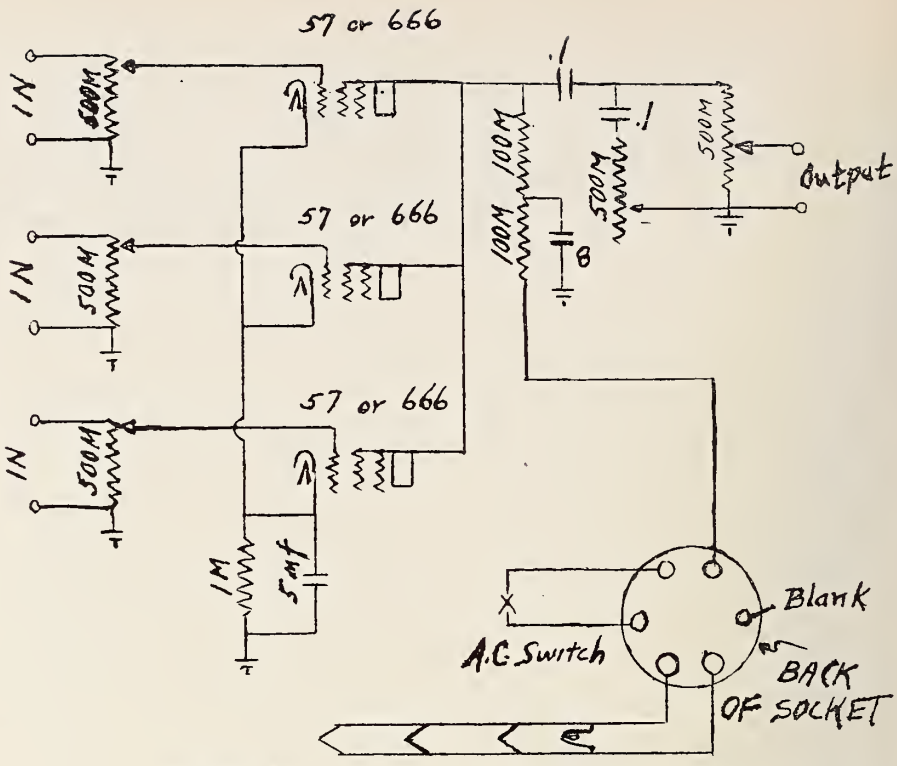


FIGURE 2

reinforcement; they merely add wires and switches and so on, and may alter the calculations for impedance match—on the other hand they help to simplify the work of trouble-shooting.

Where there are several sound sources and several speakers it is very easy to find out by switching, or by unplugging connections, whether a given trouble is in the sound source, the amplifier or the speaker.

Where there is more than one high-impedance sound source, such as several microphones of high impedance types, the amplifier will be equipped with a "mixer", either built-in or added as an auxiliary. The basic mixer circuit is shown in Figure 2, which represents an external or added type. It is too simple to need tracing in detail. There are three identical tubes (in this case pentodes wired as triodes). There are three sets of input terminals, accomodating three high impedance sound sources. Each tube acts as one-stage amplifier for the sound source with which it is connected. Each of these one-stage amplifiers has its own volume control.

The various inputs are "mixed" by the simple fact that the plates and cathods of all the tubes are wired in parallel. The output runs through the overall volume control shown at top right. In Figure 2 power supplies are derived from the amplifier through the socket shown at lower right. An indicator lamp bulb is connected in parallel with the three filaments.

The identical arrangement may be built into the amplifier, as an integral part of its circuits. Suppose Figure 2 were thus built into Figure 1. Look at Figure 1—find the 25,000 ohm resistor drawn just under the 77 tube—trace left to the four-way, grounded junction point. Now cut the wires leading upward and leftward from that point. Again, cut the wire leading leftward from the control grid of the 77 tube. Now discard everything above and to the left of the connections you have just broken in Figure 1, and substitute for them Figure 2. Wire the upper output terminal of Figure 2 (top right) to the grid of the 77 tube in Figure 1; and wire the lower output terminal of Figure 2 to the four-way grounded junction just mentioned. Now Figure 1 has a high impedance mixer input instead of a low-impedance input transformer.

Of course, the foregoing relates only to speech circuits, and it still would be necessary to draw power from Figure 1 for the power input socket shown at the lower right of Figure 2. For use with Figure 1 the tubes of Figure 2 should be of the 6C6 type, since the 57 does not have a 6-volt heater.

Practical Problems

In any entertainment reinforcing system the primary problems relate to power output, number and placement and matching of speakers, and acoustic relations between speakers and microphones.

If the power output is the same as that of the regular theatre amplifier, it will of course be adequate for the auditorium.

It is not practical to use the regular speakers, because they would throw sound directly into any microphone placed on the stage. A microphone can-

not be located in front of its own loudspeakers, because they would throw moment.

The regular theatre amplifier—if equipped for microphone input—can be used for reinforcement, but this is not the most practical arrangement, technically speaking, because microphone cable would have to be run from the stage to the projection room, and speaker cables back again to the stage. A separate amplifier located in the wings or the orchestra pit is usually preferred —but where routine operation of the amplifier is to be under control of the projectionist, then the amplifier must be located in the projection room as a rule, and the regular sound panel may as well be used.

Speakers should be located to either side of, or above, or below the microphone; they should be directional and so pointed that as little of their sound as possible will get back to the mike. They must, of course, cover the whole audience, and their number and placement will depend on the size and shape of the auditorium. A great deal of experimental pointing and repointing after hours may be necessary before the best results are obtained.

Once correctly placed and adjusted the speakers should be permanently fastened so that neither cleaning squad nor audience nor accident can change the way they are pointed.

The speakers may be interconnected in parallel or in series or series-parallel, according to whatever arrangement will match the available output impedances of the amplifier. In a series parallel arrangement make sure that all speakers receive the same sound power; and in all arrangements make sure that no speaker receives so much power that it will either burn out or distort.

Acoustic Feedback

When loudspeaker sound gets back to its own microphone in sufficient volume the result is feedback—the whole system will howl continuously and nothing else will be heard. The acoustic loss of volume, between loudspeaker and microphone, must be greater than the amplification between microphone and loudspeaker, if feedback is to be avoided. Hence proper placement of these parts, use of directional speakers and microphones, and careful pointing, all help to prevent feedback. Good quality equipment, with a very flat response curve, helps most of all.

If the apparatus is "peaked"—exceptionally efficient—at some one frequency as compared with all others, feedback at that frequency may be great enough to cause howling even though the overall volume is not. With such equipment it may not prove possible to obtain all the volume desired without running into trouble. With equipment that is equally efficient at all frequencies (which means good equipment) the overall volume can safely be raised to a much higher level.

Hearing Aids

Of course, if the loudspeakers are blaring directly into the microphone, the best system ever heard of may break down into howling.

These are earphones or similar devices through which patrons hard of hearing are able to enjoy the show. There are two general types—earphones operating through the ears, and "bone conduction units" which are worn or held against the bone just back of the ear. Sound is then heard through the bone, which helps in some forms of deafness.

Hearing aids are sometimes stolen or damaged either by curious patrons or by children; hence they are not as a rule permanently attached to the seats where they are used. Jacks, suitably wired, are fastened to a limited number of seats; the hard-of-hearing patron asks for his hearing aid at the box office, plugs it in, and returns it to the box office when he leaves. Ushers reserve the wired seats for those who need them.

Some hearing aid systems are wired to the regular sound amplifier, either directly or through a small hearing-aid amplifier. In others, the sound is picked up by a microphone inconspicuously mounted in a suitable location— perhaps directly in front of the regular loudspeakers. This arrangement will not produce feedback, since the microphone does not supply sound to the speakers, but only to the hearing aid headphones. The amplifier need not have more than one watt output.

A hearing aid system is always simple. The principal problem is securing and maintaining impedance match between the number of hearing aid units employed and the output of the hearing aid amplifier. Since the aids are plugged in and out according to patronage, it is common practice to use two-circuit jacks, so wired that when the plug is not in place a substitute resistor provides the same impedance; the act of plugging in the unit open-circuits this resistor. Thus the impedance match remains the same at all times, regardless of the number of patrons using the system.

Cry Room Speakers

In many theatres, the cry room is fitted with a small speaker of high input impedance, which is wired directly to the system amplifier. The impedance mis-match limits the volume accordingly to the capabilities of the small speaker used. Only a fraction of a watt of power is needed.

But if there is a separate entertainment system the cry room speaker would have to be switched over. In some theatres the cry room has its own small amplifier, with a microphone hung just outside the cry room and a small speaker inside. This avoids all wiring complications and switching, and may actually be less expensive than running long lengths of cable.

Lobby Speakers

Lobby speakers, used to entertain waiting standees or to direct patron traffic, commonly have their own amplifiers and sound sources. Entertainment may be provided by a record player, while a microphone enables the manager or usher to mix in traffic instructions as required. The input circuits of Figure 1, as they stand, are adapted to this service, but of course the power circuits of Figure 1 are for mobile service. A similar amplifiying arrangement with conventional power supply would be far preferable.

Lobby system speakers most be mounted not only where they will distribute sound satisfactorily, but where they will not cause feedback with the announcing microphone.

The power required of a lobby or foyer system depends on the area to be covered. Five watts is likely to be ample.

Marquee Speakers

Where local ordnances allow, speakers mounted either under or above the marquee can be used for advertising, and exhibitors have worked out some ingenious appeals in the way of talking or singing displays. Power depends on the area to be covered.

There should be a separate amplifier, with both phono and microphone pickup. If the microphone is located inside the theatre there will be no feedback problem; if the microphone is to be carried by a barker on the sidewalk feedback precautions as previously described may prove necessary. Power depends partly on the area to be covered, partly on the traffic noise that must be overcome.

Mobile Sound Units

Feedback is always a problem in a sound truck, wagon or carriage, because of the close proximity between microphone and speakers. A contact microphone, worn on the announcer's throat, is one remedy: and if it is desired that the announcer on the truck or wagon should appear to speak into a regular mike, a dummy mike may be used. Many mobile units, however, have no microphones, only record players, which, of course, never respond to loudspeaker sound but only to grooves in a record, and therefore never cause feedback.

(*Continued on next page*)

SMPE Meeting Will Feature Advances in Motion Picture Industry

AT THE 57th semi-annual technical conference of the Society of Motion Picture Engineers, to be held in Hollywood May 14-18, dramatic advances in wartime military and naval use of motion pictures and in theatre television, motion picture sound recording and reproduction, and motion picture photography and projection will be presented at nine technical sessions.

The use of film in television programming and the relationship of television and motion picture practices are among the topics of scheduled papers. Other highlights of the partially completed program include a semi-popular demonstration lecture on amateur color photography, the use of invisible infra-red light to photograph audience reaction to motion pictures, and the use of motion picture techniques in biological research.

H. W. Moyse is chairman of the SMPE Pacific Coast section. Committee chairman for the convention include the following: *papers*, C. R. Daily and Barton Kreuzer; *publicity*, E. O. Blackburn and Julius Haber; *registration and information*, Wm. C. Kunzmann; *reception and local arrangements*, Emery Huse; *luncheon and dinner-dance*, L. L. Ryder; *hotel and transportation*, C. W. Handley; *projection programs*, R. H. McCullough (35-mm) and H. W. Remerscheid (160-mm).

Over fifty papers have been listed to date with Dr. C. R. Daily and Barton Kreuzer, chairman and vice-chairman, respectively, of the technical papers committee. Abstracts of some of the papers scheduled for delivery at the conference follow.

A NEW TWO-WAY THEATRE LOUDSPEAKER SYSTEM

J. B. Lansing and J. K. Hilliard
Altec Lansing Corp.

This paper gives a description of a new two-way loudspeaker for theatres. New permanent magnet low frequency and high frequency units having replaceable diaphragms are described. These units are combined in a horn system having the following advantages: a higher efficiency, extended frequency range, permanent magnet units providing higher air gap flux densities, elimination of back stage radiation from the diaphragms, better transient response, and an improved over-all presence.

TELEVISION *vs.* MOTION PICTURE PRACTICES

Klaus Landsberg
Director of Television, Station W6XYZ, Television Productions, Inc.

The industries of motion picture production and television broadcasting can be of great mutual aid to each other. Based on the practical experience gained in the operation of our television station in the midst of a motion picture studio, the requirements of the two media are compared.

The motion picture industries' solution to problems common to those of a television station were evaluated in suggested design of television studios and equipment. Specifically the improvements in television control room facilities and a 210 Mc relay transmitter designed by the author and only recently put in operation are explained and illustrated.

New developments in large screen projection for home and theatre, as well as television network plans are discussed. A brief analysis of television's technical requirements for film further aims to aid the motion picture industry in its plans to enter the promising post-war television field.

FLAME RETARDANT MATERIALS FOR MOTION PICTURE APPLICATION

Barton H. Thompson
Paramount Pictures, Inc.

This is a report on flame retardants—outlining their developments and usages as applicable to the motion picture industry. This outline takes into consideration the following factors: the effect of weather, mildew, rot and flame retardant properties for the treatment of various materials used within the industry, both for interior and exterior applications.

FILM NOISE SPOTTER

J. P. Corcoran
20th Century-Fox Film Corp.

A machine is described by which defective splices, dirt and "pops" are detected before running the film through a regular sound reproducer.

A SYSTEM OF LENS STOP CALIBRATION BY TRANSMISSION

Emmanuel Berlant
Signal Corps Photographic Center

An apparatus is described for the measurement of relative transmission of photographic objectives, consisting of a controlled light source, condensing system, lens mount, integrating sphere, photo cell, and meter. Transmission characteristics of one hundred typical objectives are presented, together with a proposed standard method of calibration that will reconcile present practice and equipment with future problems involving low reflectance coatings and objectives designed with high index glasses.

MATHEMATICAL ANALYSIS OF A RECORDER FILM DRIVE FILTER SYSTEM

J. R. Alburger
Western Electric Co., Inc.

The behavior of a new film drive filter system is analyzed mathematically by application of both the classical method and Heaviside's operational method. The effective filtering action of the system as calculated is found to check very closely with measured values. By a study of the transient behavior of the system it is possible to compute optimum values for damping resistance and spring compliance for the purpose of minimizing the amplitude and increasing the damping decrement of the transient shock wave.

Although this analysis is applied to a specific mechanical system, it is illustrative of a general method which may be applied to a wide variety of systems.

RECORDING OF PHOTOGRAPHIC DENSITIES

John G. Frayne and G. R. Crane

The Western Electric 1100 type Densitometer has been modified to permit direct recording of H and D curves and other photographic data. A special linear 80 d. b. Speedomax Recorder permits direct recording densities from zero to 4.0.

REVERBERATION CHAMBERS FOR RE-RECORDING

M. Rettinger, *RCA* and James Stewart, *RKO*

This paper discusses briefly the method of using so-called reverberation chambers for re-recording. After a general considera-

(*Continued on page* 22)

SOUND REQUIREMENTS

(*Continued from preceding page*)

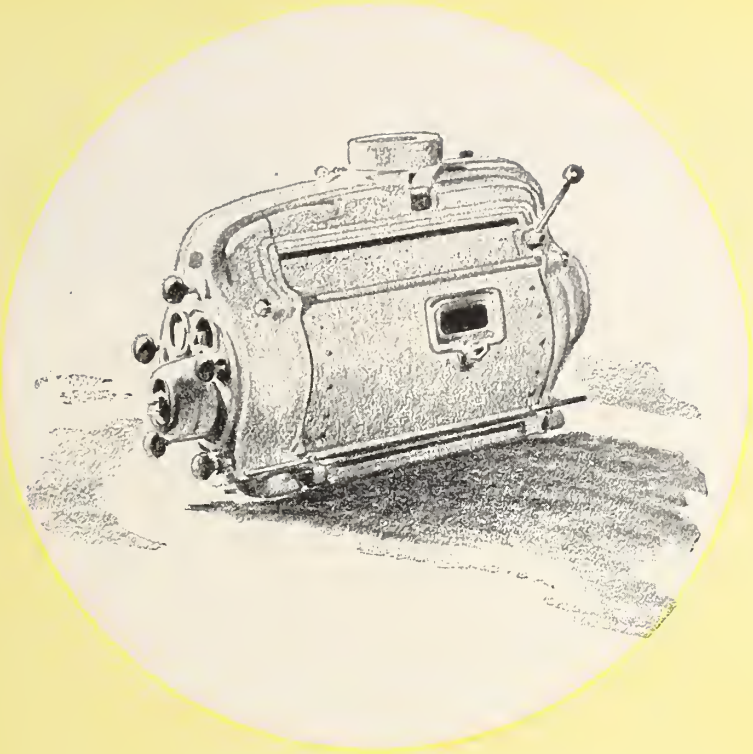
The power of the mobile amplifier depends on traffic noise and on the area to be covered, and sometimes is limited by local ordnances.

Apparatus Problems

There is nothing about the apparatus involved in any of these services that need seriously puzzle a projectionist who understands his own sound equipment. The problems today are, rather, those of obtaining apparatus, and of obtaining tubes and other replacement parts for repairing it.

It may at times prove necessary to patch together odd components, always remembering the need for both impedance match and power match. As to the latter, it is obvious that a 5-watt loudspeaker should not be wired to the output of a 10-watt amplifier; it is equally obvious that a low-level microphone will not work unless a high-gain amplifier is used to bring up the level.

Inside the auditorium, questions of both volume and feedback will vary according to attendance. A full house will need more volume—four to eight times as much as an empty house, as a rule—that is, from three to nine db more volume. On the other hand, the sound-absorbing properties of an audience will help considerably to reduce feedback. Further, sound distribution in a full house may be very different from what it was found to be when the theatre was empty. For these reasons all adjustments as to volume of speaker and speaker placement, made while the theatre was empty, should be re-checked with half-audience and full audience before they are considered final.



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IN THE SPOTLIGHT



By *HARRY SHERMAN*

MANY of our readers have asked why we denounce the incorporation of labor unions, calling such bills anti-labor. Some of them are unable to understand why incorporation, which is so popular in private enterprise, should be so objectionable to organized labor.

To these readers we point out that there are two kinds of incorporation—voluntary and involuntary. Private business concerns incorporate because they wish to take advantage of certain corporation laws, such as a limitation on liabilities. These are *voluntary* incorporations.

Advocates of the incorporation of labor unions seek to put restraints upon labor by *forcing* incorporation. Organized labor objects to incorporation because it would rob unions of all advantages of incorporation by saddling them with all sorts of forms and regulations which give no benefits but many disadvantages.

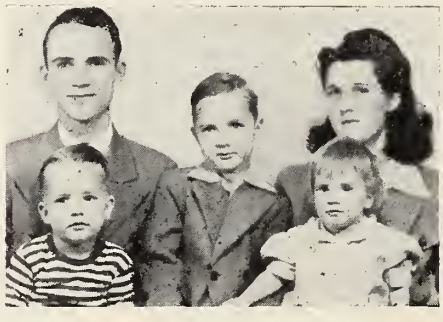
● Local No. 306 started off the 7th War Loan Drive in New York City with the purchase of $100,000 in bonds. President Herman Gelber announced that the local had purchased $75,000 in bonds in previous drives, and stated further that members of the local, through personal purchases, had subscribed for bonds estimated at about $125,000. Not bad, eh?

● It is indeed heartening to learn that there are among us a few who do not forget the men who did so much in the past years to raise the standards of the craft. "Out of sight, out of mind," seems to reflect the attitude of many of us, and when he heard recently that Charlie Travis, member of Schenectady Local No. 314, made a special trip to New York to visit George Edwards, former president of the American Projection Society and a president of Local No. 306 in its early days, our faith in the friendship of man for man was restored a bit.

Due to illness, George Edwards has been inactive for the past few years and has been confined to his home. P. A. McGuire, (International Projector Corp.) accompanied Travis on his visit to the Edwards home, and we understand that George was delighted to see his visitors. Mac and Travis informed us that the Edwards family was deeply appreciative of the many evidences shown George of the esteem in which he is held by I. A. men throughout the country.

● My, how we get around! Phil Rossomondo, EM 1/c, member of Local No. 376, Syracuse, N. Y., and former chief projectionist at Camp Sampson, N. Y., is now serving aboard a tanker sailing the Atlantic. He was thrilled no end recently when several of his shipmates, after spending some time ashore when the tanker docked at Venezuela, returned with a copy of the September 1944 issue of I. P. in which appears a group picture of the Camp Sampson projectionist staff taken at the New York State Projectionists' Association convention. Phil and yours truly are very much in evidence in the picture.

● We are deeply grieved to learn that the son of George Raaflaub, secretary of Syracuse Local No. 376, was reported missing in action in the Pacific. On our last trip upstate several weeks ago, we visited with the Raaflaubs and we were very much impressed with the fact that all their plans and hopes for the future centered around their only son, Bob, who was aboard one of our ships recently reported sunk off the Philippines. We join with Hazel and George in their prayers that the boy will turn up safe and sound.



The pride and joy of the Keeler Klan of Texas. We present to you the family of Gordon W. Keeler, member of Corsicana Local No. 393; son of Charles Keeler, secretary of Waco Local No. 597, and nephew of Bill Keeler, former business agent of Local No. 407, San Antonio. Gordon is now a member of Uncle Sam's armed forces, having enlisted shortly after this picture was taken. Something to fight for, don't you think?

● "Hank" Leslie, secretary of Local No. 348, Vancouver, Canada, for the past ten years, recently resigned from office in order to take a much needed rest. He has been working very hard at his own job in addition to that of union secretary. Hank believes that the office of secretary has become a full-time job and the strain of holding down two positions at the same time over a long period without proper relaxation has reached a point where it became impossible for him to carry on without impairing his health. This does not mean, however, that he will give up his union activities, for his popularity with the members will not permit him to play a passive role in union affairs.

● I. P. has become the stopping off place for returning I. A. servicemen. Ralph Ruben, member of Detroit Local No. 199, paid us a short visit upon his return to this country after many months of service in England and France. Ralph is now back in Detroit where he is undergoing hospital treatment. We wish him good luck and hope he soon will realize the fulfillment of many of his hopes expressed to us.

● To William P. Covert, second I. A. vice-president and business agent of Toronto Local No. 173, must go the credit for the amalgamation of the National Theatrical Employees Union (a rump union) with the Edmonton I. A. Local No. 210. This pretty well cleans up the rump union situation in Canada.

● The death of Leonard Nelson, member of Corpus Christi Local No. 604, in an airplane crash in Australia, was reported early this month. Nelson, who was only 39, was employed at the time of his death as a field engineer for Western Electric Company, installing radar equipment for the U. S. Navy. We offer our sympathy to his survivors—his widow and young daughter.

● We can't help but feel a deep glow of satisfaction when we learn that these

columns help in some measure to better the working conditions of our industry. We refer specifically to an item that appeared in the December 1944 issue of this publication in which we deplored the fact that workers in the theatrical crafts are not paid the customary time-and-a-half for overtime and double pay for Sundays and holidays as are the workers in other industries. For the benefit of those readers who may have overlooked this particular item we reprint it here:

"Unlike the employes in other industries, theatre employes are not paid time and a half or double time for working week-ends and holidays. In other industries the unions demand, and this demand has been recognized, that their members be paid extra for working on holidays. A holiday is as much a holiday to a man working in a theatre as it is to a man working in a store or or factory." . . .

As a matter of fact we have been informed by a number of I. A. local unions that double pay for Sundays and holidays is now as much an integral part of their new contracts as is the clause calling for vacations with pay. The latest of these, St. Louis Local No. 143, is now demanding a 15% increase for its members, time and a half for overtime and double pay for Sundays and holidays, on a six-day week basis.

Despite the swollen box office receipts reported in the exhibitor trade press, when the theatre owners are asked for a slight wage increase for the projection room, they are horrified and issue statements through their various organizations denouncing labor unions for their "unreasonable demands." Incidentally, we are approaching the usual "summer cut" season. Since he cannot plead a poor box office take, we wonder what excuse Mr. Exhibitor will give this year in his attempts to cut projection room costs.

● Here is a lead for the officers of the 25-30 Club. Mort Sands, former secretary of Local No. 150, Los Angeles, is eligible for membership in the Club having joined the projectionist ranks in 1912. Sands served as secretary for Local 150 almost uninterruptedly from February 1917 to February 1944, when he resigned from office and went back to his first love—projection.



Mort Sands

Mort Sands represented the Los Angeles local at all I. A. conventions from 1922 to 1942. He has been a delegate to the Calif. State Theatrical Fed., Calif. State Federation of Labor and Los Angeles Central Labor Council conventions every year since 1924. For the past several years he has been vice-president of the California State Theatrical Federation. With that background, Sands' membership in the 25-30 Club would be an asset. How about it, Mort?

● Cpl. Walter A. DuPre, member of Local 233, Buffalo, N. Y., recently called at the offices of I. P. only two hours after he landed in New York on his way home from the European battlefronts. He served with the Signal Corps in Africa, Italy, France and Germany and has many an interesting story to tell of his experiences with the armed forces abroad. DuPre proudly showed us a wrist watch the members of Local 233 presented to him upon his enlistment.



Cpl. W. A. DuPre

For a very interesting account of projection overseas, we refer our readers to a letter DuPre sent to this publication from somewhere in Europe, which appeared in the "Letters to the Editor" columns, March 1945, issue.

● Again the trade press worked itself into a lather recently over the reported refusal of Local No. 225, Atlanta, Ga., to "cooperate with the Veterans Administration in training wounded veterans."

One of the leading exhibitors in Atlanta, evidently fired with patriotism, or something, reported that two physically handicapped veterans sent to two downtown theatre projection rooms by the Veterans Administration to learn the trade received the cold shoulder from the union. Of course, this afforded Mr. Exhibitor an excuse to wrap himself in the American flag and wax indignant over the unpatriotic attitude of union officials, blah. blah. and more of the usual blah.

For the benefit of this patriotic exhibitor and for the officials of the Veterans Administration we reprint here excerpts from an article "A Few Postwar Facts" by Thad Barrows, president of Boston Local No. 182, which appeared in our September 1943 issue:

". . . Every I. A. local union has pledged itself to return to every man the position he held prior to his enlistment. In many cities it will be the duty of those in power to find employment for the thousands of men who will return home after the cessation of hostilities and who will rightfully expect some reward for the hardships endured on the battlefronts.

"Facts must be faced. We know that thousands of men have been trained as motion picture projectionists by the army and navy, and no small number of them will seek employment in our craft. I feel that it is our duty to take care of as many of these men as possible by admitting them to membership in the I. A.

"In my opinion, the first and most important step is the abolition of one-man operation in the projection room. This can be done if we agree to place in the projection room of every theatre now having a one-man shift a returned serviceman who will work together with the regular projectionist on the job. In so doing we will not only give the ex-soldier or ex-sailor a chance to rehabilitate himself, but we will also assure the patrons of these theatres a greater measure of safety."

What have you to say to that, Mr. Exhibitor?



● Meet William Richardson, member of Local 528, Kingston, Ont., Canada. Bill first began his career as a motion picture projectionist in London, England, in 1910. He came to Canada in 1912 where he ran an old Edison Portable machine on one-night stands in the prairie provinces. After three years he decided that he had enough of the wide open spaces and settled in the eastern part of Canada where he obtained theatre work.



Bill Richardson

In 1919, Bill joined the Toronto projectionist local and he became a member of the Kingston local in 1943. He takes a keen interest in all union activities and the office of sergeant-at-arms, which he now holds, is his first since becoming a member of Local 528.

● Three broken ribs suffered in an automobile accident have incapacitated our very good friend, C. E. (Red) Rupard, Local No. 249, Dallas. Come on, Red, get out and get going.

● Solly Pernick, former business agent of Local No. 1, New York City, now touring U. S. army camps overseas as manager of an USO unit of the hit musical.

(*Continued on page* 26)

Television Developments

By *JAMES FRANK, Jr.*

THERE have been a number of interesting developments in connection with television in the past several months, none of a radical nature. It must constantly be kept in mind that theatre television will be a segment of the entire television industry, so that many of these current developments are not directly related to theatre television. Projectionists and other members of the motion picture industry are. however, interested in the broad television developments in order to determine how the various problems that arise will affect television in the theatre.

Last October the Federal Communications Commission held public hearings and received a considerable amount of testimony including a detailed report from the Society of Motion Picture Engineers regarding reallocation of frequency channels. not only for television, but for frequency modulation and other communication purposes. The preliminary decision of the FCC was announced several months later and it provides for allocations of fewer channels for television purposes in the portion of the frequency spectrum in which channels for television had been previously allocated.

At the same time it was announced that certain channels in the higher portion of the frequency spectrum would be allocated for experimental purposes. Thus a compromise was made which would permit commercial broadcasting of television in the present portion of spectrum during the period that experiments were to be conducted to determine the suitability of ultimately shifting to the higher frequencies.

Preliminary Recommendations

These same preliminary recommendations provide a complete shift of FM radio broadcasting from the present portion of the spectrum, namely 42 to 50 megacycles to a portion from 84 to 102 megacycles, which would provide a considerably greater number of channels. It is these recommendations that have particularly stimulated considerable discussion in the industry. and new hearings have recently been held to determine whether these preliminary recommendations should be made final, or whether it might be better to change the frequency band for FM radio broadcasting to some intermediate portion of the spectrum.

Either change would make it necessary to modify present FM radio receivers, although the initial estimates of such receivers that would become obsolete appear to be grossly exaggerated. Under some conditions it seems reasonable that the receivers can be modified by the addition of a kit to permit operation on the new frequencies. In any event, the total number of FM receivers in use is probably 20% less than the 500,000 publicized.

Furthermore, a considerable proportion of the instruments in use include regular AM broadcast receivers and phonographs, so that even if they were unable to use the FM part, they would not become entirely obsolete. The principal differences of opinion on this matter within the industry are technical and resolve around the question as to whether entirely satisfactory and dependable service is possible in the present portion of the spectrum, and to what degree it will be improved if a shift is made over to the intermediate portion, or to that portion included in the preliminary recommendations of the FCC.

A final decision has not yet been announced, but it would seem that the preliminary recommendations will probably be reaffirmed. All of this has some bearing on television because it indicates the trend of the FCC, television uses of FM, and emphasizes that the allocation of frequencies for FM are related to allocation of frequencies for television.

Enlarged Screen Images

The Radio Corporation of America presented a very interesting technical paper at the annual Fall Conference of the Society of Motion Picture Engineers last October in New York, and also at the first annual meeting of the Television Broadcasters Association last December. This paper dealt with the development of larger screen television images for home receivers. This was accomplished by enlarging a very bright image on a relatively small fluorescent screen through the use of a reflector, and a correcting lens. This system has been described in some detail in a previous issue of this publication.

The principal problem to be solved was to find a method of economically producing in large quantities a suitable corrective lens. This has been accomplished, and several weeks ago a demonstration of such a receiver was presented to the trade press at Radio City.

The television image on the receiver demonstrated was approximately the size of a normal double spread newspaper, and it was considerably brighter than the old smaller images. This marks a very important development in that it answers one of the principal criticisms of home television, emphasing the important requirement for larger images.

It is interesting to note that the Emerson Radio and Phonograph Corporation has been publicizing a system (to be produced in the post-war period), which provides for projecting a television image from a relatively small bright fluorescent screen to one similar to a 16-mm motion picture screen in the home. There would seem to be some advantage in accomplishing this enlargement within the console of the instrument, rather than having to project the picture across the room on a separate screen.

The General Electric Company recently announced the demonstration of its larger screen home television receiver.

All of these accomplishments are of significance to us in that the more nearly perfect becomes large screen home television receivers. the better should become large screen television images for theatrical uses.

Scophony Developments

A very interesting technical paper was presented at the March monthly meeting of the Atlantic Coast Section of the Society of Motion Picture Engineers by Dr. A. H. Rosenthal, Director of Research for Scophony Corporation of America. The subject of his discussion was "Problems of Theatre Television Projection Equipment." This presentation included a detailed description of the two basic Scophony Television Systems, known as Supersonic and Skiatron.

Dr. Rosenthal and Scophony have for many years advocated large images of at least 24″ width in home television receivers. They also have been staunch advocates of systems involving the projection of modulated light of high intensity for the purpose of producing not only large images for home use, but also the larger images required in the theatre. This type of projection is similar to the one that we are so familiar with in the projection of stereopticon slides and motion picture films. In such a system, a light of whatever intensity that is desired and available is projected through a modulated device, and through an optical system which enlarges it on to a suitable reflecting screen.

In the case of motion pictures, the film with its respective light. intermediate, and dark portions. does the modulating of the light from the carbon arc lamphouse, producing the rapid series of

(*Continued on page* 25)

Presenting: J. H. (Hank) Leslie



J. H. (HANK) LESLIE, an old-timer who naturally has grown up with the movie industry, is another of the craft who "passed for 18" when he got his projectionist's license, but in reality was several years younger. Most of the old-timers, when their biographies reach print, seem to have been precocious, and in appearance somewhat older than their actual time upon this planet.

Hank, who has served as secretary of I. A. Local No. 348, Vancouver, B. C., for approximately ten years, was born in Moosomin, Saskatchewan, on the morning of January 27, 1896. He has been an early bird ever since, taking advantage of the opportunities offered to make a mark for himself, particularly in union circles. He asserts he is a true Canuck because both his parents, of English and Irish descent, were born in Canada.

His early ambition was to become a printer and he worked happily in a printing office in Indian Head, Sask., after school and on holidays. However, after his father, who was a contractor, built the local "opera" house, he decided to become an actor, and through paternal influence became chief errand boy for the manager, delivering handbills and putting up posters—all for the magnificent sum of $1 a month plus a free pass to the show.

It was about this time that Leslie received his first thrill in seeing a movie. The projector was set up and roped off in the center of the auditorium, and even though the attraction was "Peck's Bad Boy." Hank saw little of the picture, as the machine itself fascinated him most.

In 1909, when the Starland Company built the first movie theatre in town, Hank again changed his life's ambition and decided to become a motion picture projectionist. He lost no time in making the acquaintance of the operator, Paul Kane, and shortly thereafter Hank was cranking the machine and running illustrated song slides while Kane spliced the film.

The Leslie family moved to Regina, Sask., in 1910, where our hero got a job as doorman in the Elite Theatre, resplendent in uniform. The next year he managed to become an apprentice in the projection room. After several months he secured a job as projectionist in the new Princess Theatre. The salary was $25 per week for 6 matinees and six evening shows.

This promising interlude, however, was interrupted when Hank's family moved again, this time to Vancouver. No projectionist's job was available there so he went back to the printing art. Here it was that he learned it was compulsory to have a license to operate a projector, but the minimum age was 18 and Hank was only 16. Only 16, but he was 5 feet, 11 inches tall, and with the help of a Mr. Lamont, who was superintending the installation of projection equipment in a new theatre, he made the grade and got his license.

It was in 1913 that he first became truly interested in organized labor. The Vancouver local had run into a "split" among the members, with each group seeking his allegiance. He was finally appointed to a committee whose instructions were to try to attempt an amalgamation of interests. The result was a total reorganization of both parties, and the birth of Local No. 348.

Leslie's union activities really commenced at this time, as the fact that he is a charter member of 348 inspired him to take a keen interest in the local's welfare. He has served the local in almost every official capacity, and has held the office of secretary for about ten years, a post he recently relinquished so that he might take a well-earned vacation after many years of hard and arduous work.

He attended his first I. A. convention in 1926, in Cleveland, Ohio and represented his local at four others. He was elected I. A. delegate to the Trades and Labor Congress of Canada at the 1944 St. Louis convention, and as an I. A. representative he was privileged to attend the Diamond Jubilee Convention of the Trades and Labor Congress of Canada which was held at Toronto in the same year.

Leslie was a charter member of the A.P.S., Chapter 11, and at the time this organization was dissolved he held the office of secretary to the board of governors. He also assisted in inaugurating a new chapter in Seattle, Wash.

Early this year, when Famous Players, Ltd., celebrated its 25th anniversary in show business in Canada, Hank was quite surprised to learn that he qualified as one of the company's original employes, as a charter member of the 25-Year Club which the company formed in commemoration of the event.

Hank has few hobbies, and they are outdoor sports, with fishing in the lead. He has a son in the Royal Canadian Navy, who also is a projectionist, having been a member of Local 348 since 1937.

One of Leslie's memories is a wager he made a few years ago with a pianist who worked in a theatre with him. He bargained to teach the pianist the projectionist's craft if the pianist would teach him to play the piano. Hank learned to play the piano, and much to his surprise, the pianist some time later turned up in Vancouver as a full-fledged projectionist.

Having grown up, as one might say, with the motion picure industry, Leslie has witnessed and experienced many changes—in the craft and in the labor movement as a whole, and although he devoted his best years to show business, he has no regrets and is proud of his association with both the industry and the I. A.

A.S.A. ADOPTS NOMENCLATURE STANDARDS

The American Standards Association announces that seemingly esoteric terms, such as "dupes," "dailies" and "background plates," which constitute part of the daily speech of motion picture film production, have been formally defined for the first time in the new American War Standard Nomenclature for Motion Picture Film Used in studios and processing laboratories, Z52.14-1944. The new standard developed by the A.S.A. War Committee on Photography and Cinematography in cooperation with the armed forces, the War Production Board, the Society of Motion Picture Engineers, the Research Council of the Academy of Motion Picture Arts and Sciences, and the motion picture industry, represents the initial results of a unified effort to prepare a standard reference source for motion picture terminology.

It was pointed out that lack of a common terminology has interfered with both the civilian production of films for the entertainment of the armed forces and the armed forces' own production of training films, causing many unnecessary delays and misunderstandings during the making of both training and morale films for use by the services and on the home front.

Also included in the news standards is a flow chart which clearly shows for the first time the mechanics of the commonly used methods of film production from the shooting of the original sound and picture negatives to the making of the final release print for theatre or field showing. Copies of the standards may be obtained from the A.S.A. for 25 cents.

NEW ORTHOSCOPE PROJECTION LENSES DEMONSTRATED

A demonstration of the newly developed orthoscope supplementary projection lenses was held at the recent SMPE May conference in Hollywood. The new lenses, developed by Hal Huff, optical engineer, and manufactured by the H & H Optical Co., Hollywood, are distributed exclusively through National Theatre Supply Co.'s 28 branches in principal cities from coast to coast.

Projectionists' Course on Basic Radio and Television

By *M. BERINSKY, E. E.*
MEMBER OF INSTITUTE OF RADIO ENGINEERS

XI—ALTERNATING CURRENTS

THE direct current generator is very much like the direct current motor. We have learned that a voltage is induced in a wire whenever it rotates in a magnetic field. This voltage is given by the formula $e=B \times L \times V \times 10^{-8}$ volts, where e is the induced voltage, B is the flux density of the field in gausses, V is the velocity of the conductor in centimeters per second, and 10^{-8} is a constant which equals .00000001.

This formula holds true when B, L, and V are mutually perpendicular, as is shown in Figure 1. The direction of the induced current can be determined by Fleming's Right-hand Rule, which reads as follows: Set the thumb, forefinger, and the middle finger of the right hand at right angles to one another. If the forefinger points in the direction of the lines of flux (north to south), and the thumb in the direction of the motion of the conductor, the middle finger will point in a direction opposite to the flow of electrons in the conductor. This rule is illustrated in Figure 1.

In a practical generator the conductor is wound in the form of a coil. Only in this way can we secure enough voltage from the generator to be of practical use. Several conductors are placed in each armature slot. The voltage generated in any type of rotating equipment is always of an alternating nature. Figure 2a shows a conductor rotating in a magnetic field. The type of voltage which is generated in this conductor may be seen in Figure 2b. This is known as a sine wave and represents an alternating current or voltage because it is positive for one half of its period and negative for the other half. The polarity of such a wave is always alternating, that is, it changes its polarity from positive to negative periodically. This voltage is taken from the conductor by means of slip rings and brushes.

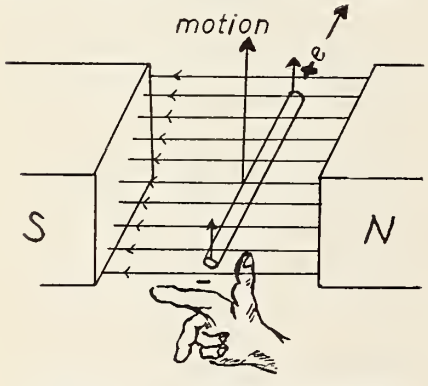


FIGURE 1. *Fleming's right-hand generator rule.*

The reason for this alternating voltage may be determined by referring to Figure 1. If the conductor in this illustration were pulled up, the induced current would be seen to flow away from the reader. If the conductor were pulled down, Fleming's Rule would show that the current had reversed its direction and it would be flowing towards the reader.

In Figure 2 the conductor moves down for one-half of a revolution and moves up for the other half. The output of the generator periodically will change direction and will, therefore, be alternating.

In order to secure a uni-directional output from such a generator a commutator must replace the slip rings shown in Figure 2. The output will then be like that shown in Figure 3. Since the voltage in Figure 3 does not reverse its direction because of the commutator, the generator containing a commutator is known as a direct current generator. It must be remembered, however, that the voltage which is induced in the coil itself is alternating. The commutator in the direct current motor served a similar function, namely, to cause rotation in one direction only.

The voltage wave shown in Figure 3 is not the pure direct current that is available from batteries; the voltage is not very steady and is known as pulsating d. c. A voltage similar to that available from batteries is desirable from direct current generators. Such a voltage would practically be a straight line above a reference axis as illustrated in Figure 4a. In the practical d. c. generator such a voltage wave form can be obtained by winding several coils at various angles to each other on the armature and using separate commutator segments for each coil.

For a generator whose armature consists of two coils wound 90° apart, and four commutator segments, the output will resemble that of Figure 4b. The output of Figure 4b is shown to be much smoother than that of Figure 3 but it is not as smooth as that of Figure 4a. A still smoother output than that of Figure 4b may be obtained by adding more coils and commutator segments to the armature.

The connections of the direct current shunt generator are similar to the direct current shunt motor. As a matter of fact, a shunt motor may be operated as a shunt generator.

In a generator, mechanical energy is applied to the shaft and electrical energy is taken from the brushes. The generator is driven by a prime mover such as a steam turbine, gasoline engine, or electric motor. In the shunt generator, an external field supply is not necessary. A small amount of magnetism remains

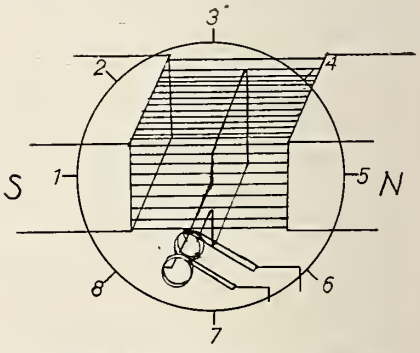


FIGURE 2A. *Single-coil two-pole alternator.*

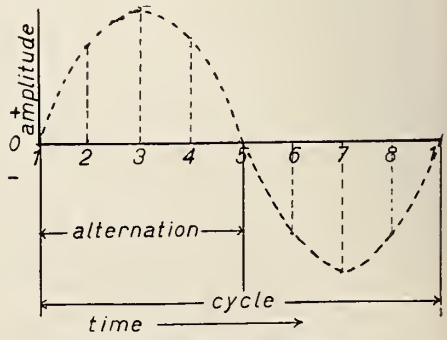


FIGURE 2B. *Sine wave.*

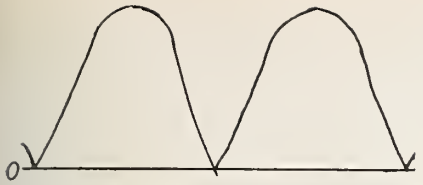


FIGURE 3. *Pulsating direct current.*

in the pole pieces of a generator after the machine has been shut down; this is known as residual magnetism.

When the generator is started the armature coils rotate between the pole pieces and cut the residual magnetism. A small voltage is induced in the armature. The shunt field is connected across the armature and the small voltage is then applied to the field, increasing the field current. The small field due to the induced voltage will re-enforce the residual magnetic field and the voltage induced in the armature will commence to build up. A variable resistor in series with the field will allow adjustment to rated voltage output.

Shunt Generator Connections

The connections of a shunt generator are similar to those of a shunt motor, the exception being that the generator does not plug into the line, since the output of the generator is the line. Shunt generators have a voltage characteristic that drops with increasing load. These generators sometimes fail to build up to rated voltage—the cause may be one or more of the following:

1. *The shunt field may be connected in such a way that the initial current through it on starting is of such a direction as to buck the residual magnetism instead of increasing it. Under these conditions the generator cannot build up. A simple test is to open the field while the generator is running. If the voltage rises, it indicates a bucking field, and the field connections should be reversed. If opening or closing the field produces no effect on the voltmeter it may be assumed that the field is open. A more accurate check can be made with an ohmmeter.*

2. *The field resistance may be too large. Reduce the field rheostat until the voltage builds up.*

3. *Poor brush contact producing high resistance between commutator and brush.*

4. *There may be no residual magnetism due to jarring or too long a period of idleness. Connect the field across a separate field supply temporarily. This will restore the residual magnetism to the pole pieces. The procedure is known as flashing the field.*

Compound generators are similar to compound motors. A rheostat in series with the shunt field is used for voltage adjustment. When the rated-load voltage is greater than the no-load voltage the generator is overcompounded. This means that the generated voltage will remain nearly constant with increasing load. Such a condition is desirable especially for generators that supply lighting loads.

With a shunt generator the voltage output would drop with increasing loads. If such a generator were used for supplying lighting loads, the lights would grow dim during periods of heavy overloads. This difficulty is overcome with an overcompounded generator.

Compound generators can be undercompounded. This would be the case if the generated voltage were to drop rapidly with increasing load. For obvious reasons compound generators are seldom undercompounded.

Series generators are also used in electrical work. In the series generator the field winding is connected in series with the armature and the external circuit. It consists of a small number of turns of wire having sufficiently large cross-section to carry the rated current of the generator. The series generator in most instances is used for constant current work, in distinction to the shunt generator which maintains a fairly constant voltage.

If the series field is connected in such a manner that the current due to residual magnetism aids this magnetism, the generator will build up, provided the resistance in the external circuit is not excessive. The series generator has been used in series arc lighting, because of its ability to maintain constant current.

Alternating Currents

Approximately 90% of the electrical energy used for commercial purposes is generated as alternating current. This does not mean that alternating current is superior to direct current so far as applicability to industrial and domestic uses is concerned. There are many instances where direct current is necessary. For these purposes, however, alternating current is converted to direct current by means of rotating or static machinery.

There are many reasons why electrical energy usually is generated as alternating current. For instance, alternating current can be generated at a much higher voltage than direct current. This voltage, can be raised or lowered very easily and efficiently by means of transformers, thereby permitting the economical transmission of alternating current over long distances by using high transmission voltages. These high voltages can be efficiently reduced at the receiving end of the transmission line so that they may be used for lighting and power.

Another reason for the preference for alternating current is that large alternating current generators have an efficiency of approximately 97%. The large turbines which drive these generators have high boiler room efficiencies. An example of the size of some of these generators are the two machines which are in operation in the Hudson Avenue station of the Brooklyn Edison Company, New York. These are both 200,000 kv-a, four-pole, 60 cycle, 1800-r.p.m., 16,500-volt, single-shaft turbine alternators. At 1,000 r.p.m., it is difficult to design a direct current generator having a rating of even 1,000 kw. For constant-speed work alternating current motors usually are preferable to direct-current motors.

Sine Waves

Figure 2a shows a coil rotating in a magnetic field. It has already been pointed out that when a wire cuts a magnetic field or a magnetic field is moved past a wire an e.m.f. is generated in the wire. In Figure 2b we see the shape of the voltage or current wave which is generated in the wire, assuming that the output from the rotating coil is taken from a pair of slip rings. The wave is seen to start at zero, which reaches a maximum height or amplitude in a positive direction, return to zero, go to a negative maximum, and then return to zero.

Here is the reason for the shape of

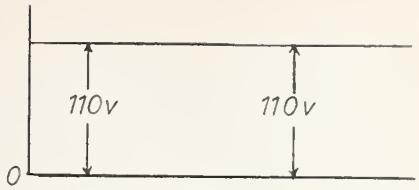


FIGURE 4A. *110 volts, pure direct current.*

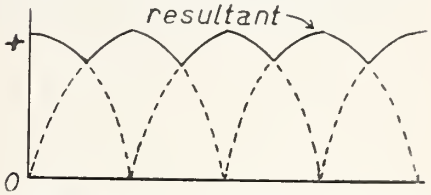


FIGURE 4B. *Smoothing effect of two pulsating direct currents displaced by 90°.*

APRIL QUESTIONS AND CORRECT ANSWERS

1. **(Q) From which material is the commutator made?**
   (A) ***Copper.***
2. **(Q) Which motor is best suited for speed control?**
   (A) ***Shunt motor.***
3. **(Q) Which type of motor may wreck itself if its load is removed?**
   (A) ***Series motor.***
4. **(Q) Which type of motor is best suited for trolley cars?**
   (A) ***Series motor.***

GOOD RESPONSE ABROAD TO RCA's THEATRE EQUIPMENT PROGRAM

Active interest is being demonstrated by theatres in overseas territories in RCA's program for a complete line of theatre equipment, according to Karl Streuber, manager of the newly consolidated theatre and sound equipment department of the RCA International Division. He declared that since the first announcement of plans for the program there has geen accumulated marked evidence of a world-wide demand for new theatre equipment, both for modernizing existing theatres and for building new ones.

"RCA's plans to provide theatres with projectors, generators, screens and other equipment," Mr. Streuber added, "as well as RCA sound systems, have been in step with this demand and have been welcomed by distributors abroad.

"Our expanded program of distribution is itself the fulfillment of a demand from theatre owners, dealers, distributors, technicians and manufacturers in many parts of the world. The established lines which we have grouped into one family of products permits the extension of RCA standards to cover the entire field of theatre equipment."

He aso pointed to the fact that motion pictures during the war "have demonstrated their remarkable versatility on the home front as well as in training areas and in the battle zones."

WILL WHITMORE NAMED ADVERTISING MANAGER FOR W. E.



Will Whitmore has been named advertising manager of the Western Electric Company, succeeding H. W. Forster, deceased, it was announced by F. B. Wright, director of public relations. Mr. Whitmore had been advertising supervisor. He joined the company in 1929 and has been with the organization continuously ever since. His work in the public relations department covered all phases of publicity, advertising and magazine editing, and his articles, especially in the field of popular science, have appeared widely in business, trade and photographic magazines.

Mr. Whitmore for a number of years during the post-introductory phase of the talking motion picture development, specialized in the subject of sound films. He served as chairman of the publicity committee of the SMPE for nine years. Through his efforts many of the motion picture industry's more than 50,000 technicians gained their initial insight into the complexities of recording and reproducing sound on discs and films.

Mr. Whitmore, a member of the SMPE, the Radio Executives Club and the Industrial Advertising Association, was born in Lockhart, Texas.

1944 SALES OF GENERAL ANILINE RISE 24.7% OVER 1943

Sales of General Aniline & Film Corporation during 1944 were $73,311,178, or 24.7 per cent more than the previous year, and the highest in the history of the company. Operating profit before taxes increased more than 25 per cent, to the record level of $16,984,637, comparing with $13,551,713 in 1943. Federal taxes on income also reached a new high level, totaling $12,123,000 in 1944 as compared to $8,989,267 in the previous year.

The company reports net profit after taxes and provision of $1,000,000 for special accruals due to wartime operations at $4,813,276, or $6.57 per share of Common A stock. This is an increase of 18 per cent over the revised net profit of $4,062,527, or $5.54 per share of Common A stock in 1943. Excluding profit of $1,221,347 on sale of securities, 1944 net profit was $3,591,929, or $4.90 per share, as compared with $3,605,069 or $4.92 per share on a similar basis in 1943.

FAZALBHOY OPENS N. Y. OFFICE IN RCA BUILDING

Fazalbhoy, Ltd., India, has opened a New York office in the RCA Building, 30 Rockefeller Plaza, Room 5028, according to an announcement by its New York representative, Allan E. Currimbhoy. The office was organized to develop closer contacts between the home offices of Fazalbhoy, Ltd., in India, and the prominent American manufacturers of motion picture equipment, whom Fazalbhoy, Ltd., represent in India on an exclusive basis. These include Simplex projectors and Peerless Magnarc lamps.

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the wave. As the coil rotates in a uniform magnetic field, it cuts a certain amount of flux depending upon its position in the magnetic field. The amount of e.m.f. generated in the coil depends upon the amount of flux cut by the coil at any given time. This e.m.f. is zero when the plane of the coil is perpendicular to the field and reaches a maximum value when the plane of the coil is parallel to the field.

The wave shown in Figure 2b is known as the sine wave. It is so called because the value of e.m.f., which is generated at any instant, is proportional to the sine of the angle which the coil makes with a plane through its axis and perpendicular to the direction of the magnetic field. The wave shown in this illustration repeats itself periodically as the coil rotates in the magnetic field, and because it repeats itself in cycles, is called a cycle.

One-half of this wave, the period during which the voltage varies from zero to a positive maximum then back to zero, is called an alteration. The period during which the voltage varies from zero to a negative maximum then back to zero is also known as an alternation. We see, therefore, that each cycle contains two alterations. All sine waves have this characteristic. (The term "sine" is a trigonometric function and will be thoroughly explained in a later article.) One alteration represents 180 electrical degrees, and one cycle represents 360 electrical degrees. In an alternating current generator having only two poles, one alteration will be produced when the coil makes one-half revolution or turns through 180 space degrees, and a cycle will be produced when the coil completes one revolution or turns through 360 space degrees.

The number of cycles produced by a generator in one second is called the frequency. Thus it may be seen that the relation between space degrees and electrical time degrees in a two-pole generator is the same. This does not hold true for other types of machines. For example, in a four-pole machine one alteration will be produced when the coil makes a quarter of a revolution —that is, when the coil rotates through 90 space degrees it will produce a voltage wave which contains 180 electrical degrees. The coil will generate a voltage wave of 720 electrical degrees or two complete cycles when it makes one complete revolution.

Speed, Poles, and Frequency

A definite relation exists among speed, poles, and frequency. This relation is given by the following formula:

(1) $F = \frac{P \times S}{120}$. Where F is the frequency in cycles per second, P is the number of poles, and S is the speed in r.m.p. (revolutions per minute). When the frequency and the speed are known we may find the number of poles in the generator by solving the formula for P. The formula would then read

(2) $P = \frac{F \times 120}{S}$. When the frequency and the number of poles are known the speed may be found by the equation

(3) $S = \frac{F \times 120}{P}$.

Here are some typical examples. What frequency will be generated by a 6 pole alternator, running at 500 r.p.m.? Let us use formula (1) above.

$F = \frac{6 \times 500}{120} = 25$ c.p.s. (cycles per second).

A 60-cycle alternator is rotating at 1800 r.p.m. How many poles are contained in the machine? We will use formula (2) above. $P = \frac{60 \times 120}{1800} =$ 4 poles.

MAY QUESTIONS

1. **A 60 cycle, 8 pole, alternator is rotating at how many r.p.m.?**
2. **How many poles are contained in a 25 cycle, 180 r.p.m. alternator?**
3. **What is the frequency of an 8 pole, 900 r.p.m. alternator?**

The correct answers to these questions will appear in the next issue.

AT YOUR SERVICE

This department is a collection of random thoughts and some not so random: fact, fancy and opinion relating to the man behind the man behind the gun—the serviceman. The prime purpose of this section is to promote a closer relationship between serviceman and projectionist based on a better understanding of their mutual problems through an exchange of news and views, kinks and kicks. To this end, contributions relative to any phase of the serviceman's activities are invited.

Lubrication of W. E. 709 Drives

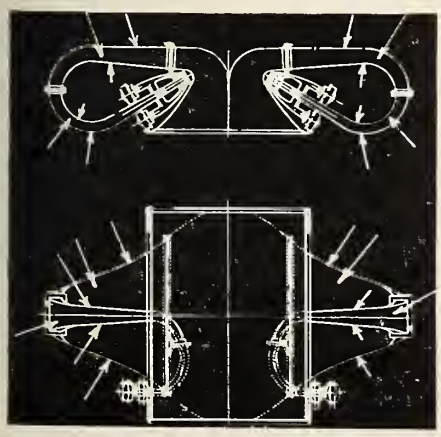
After experimenting with a number of lubricants for the W. E. 709 drives, I found that the Socony No. 90 gear oil works best of all with practically no leaks. This is a heavy oil with good lubricating properties and the drives run quieter than when Texaco chassis "S" lubricant is used. This gear oil has been used in several installations and the projectionists reported that there has been no leakage. —D. W. McMillan, *RCA.*

(*The type and viscosity of grease also depends upon the operating temperature. A projection room with a high temperature in the southern part of the country requires a heavier lubricant than one with a lower temperature. Texaco chassis "S" is the recommended grease for the W. E.* 709 *drives.*—ED.).

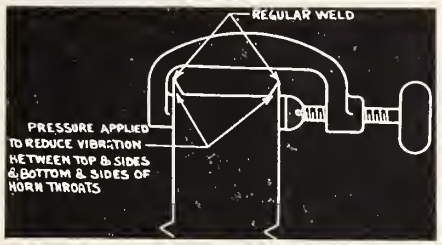
Eliminating 16-Type Horn Rattles

Here is a treatment that will improve operation of the 16-type horn and which proved very effective in the two instances in which it was tried. One of these cases was a conversion to high power and equalization, and the other was a wide-range job with 86 amplifier. The finished job, carefully executed, is workmanlike looking, clean, dry and odorless, and costs less than $2 for the material used.

About eight or ten yards of the heaviest deadening felt obtainable is the material necessary for the job. This probably will be 1½ lb. gray paper felt, the same



Surfaces indicated by arrows are to be covered.



that is used under linoleum on floors. About three pints of Linoleum Paste (not cement and it need not be waterproof) is required for an adhesive. This paste is not recommended for felt when applied to a floor, but I have found it very effective in the above uses. Also, it is very easy to remove from the hands.

The felt is cut into sixteen patterns to fit the top, bottom, front, and rear sides of the two tapered horn sections between the cast iron receiver attachment and the main horn bell. Before application, and using a large 6, 7 or 8 inch "C" clamp, pressure is applied against the sides of these two horn throat sections, close to and along the weld, so as to press them against the top and bottom sections at the bend, as shown in the diagram above. This appears to have some value in changing the resonance point of the larger front and back sections, and reduces the possibility of vibration between two metals at the inside of the weld. Pressure should be applied every inch or two until the entire length of weld is covered.

With the felt cut to size, a thin layer of the paste is spread so as to completely cover one side of the felt which is then pressed against the proper horn section. All sections should be checked for complete adhesion 15 minutes or so after application when the paste sets.

In one instance, the *EW* job, a very bad rattle disappeared after this treatment, and on the equalized job, not only was a horn rattle completely eliminated but much better results were obtained in the 3-500 cycle range.—F. Pfeiff, *ALTEC.*

Correct PEC Voltage Important

Since there is a scarcity of glassware due to wartime restrictions it is important that phototubes should be operated at the correct anode potential. Power supplies furnishing the polarizing voltage to the phototubes must be checked with a high resistance instrument, preferably an infinite impedance voltmeter such as the Volt Ohmyst Junior, or any reliable V.T.V.M. When in doubt adjust the voltage on the low side of that prescribed for safe operation.—A. D. Turnbull, *Dominion Sound Equip., Ltd.*

Oil Seepage from Oil Pans

If you are troubled with oil seepage around edges of oil pans under projectors, lay a piece of heavy thread along the inside of the offending edge and run the thread out to the pan drawing-spout. Capillary action will "draw" the oil through the thread and cause it to drip off the end.

Credit projectionist Haney, Grove Theatre, Dallas, Texas, for this idea.—W. J. Zeidlik, *ALTEC.*

Brush Squeaks

To prevent brushes from squeaking, bevel them with a file at point of spring contact, as shown in the accompanying

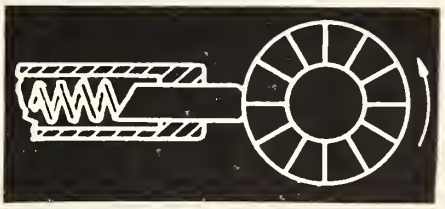


diagram. The idea is to cause the spring to hold the brush against the wall of the brush holder in the direction of rotation. It works fine for me.—Steven Welsh, *ALTEC.*

96 Cycle Hum from Cyclex Arc Lamp

Recently a 96 cycle hum showed up in the sound system of a theatre equipped with Cyclex arc lamps. This would occur regardless of whether or not the arc lamps were lighted. Additional bonding between the projector base and water pipe would reduce the hum not eliminate it completely. It finally was entirely cleaned out by installing insulating bushings at the arc switches so that the Greenfield cables from the Cyclex transformers were isolated from the projector frame. These transformer

(*Continued on page* 27)

SMPE ABSTRACTS

(*Continued from page* 12)

tion of decay of sound in reverberant rooms, there is discussed the case where the reverberation of the chamber is superimposed upon that of the room in which the sound was originally recorded. Also discussed in the paper is a brief description dealing with the construction of a double reverberation chamber.

IMPROVED FILM RECORDING CHANNELS

C. R. Daily, Ph. D.
Paramount Pictures, Inc.

Improved scoring and production sound recording channels, which incorporate a number of new constructional and operating features, are described. The new production channels are truck-mounted, carrying their own battery and rectifier type power supplies. A complete line-up panel has been designed, which materially simplifies test procedures.

DUPONT FINE GRAIN SOUND FILMS, TYPES 232 AND 236

Hollis W. Moyse
E. I. DuPont de Nemours & Co., Inc.

A description is given of the characteristics of two new DuPont fine grain sound films. Type 232 is a positive used for white light printing in conjunction with high gamma variable density sound track negatives. Type 236 is a fine grain recording negative film adaptable to both low and high gamma variable density sound recording techniques.

A SIMPLIFIED RECORDING TRANSMISSION SYSTEM

F. L. Hopper and R. C. Moody
Western Electric Co., Inc.

This presentation describes a simple, compact, lightweight recording transmission system which is adaptable to single film recording, or for use with double film systems where simple and inexpensive equipment is a requisite.

PROGRESS REPORT ON WAR STANDARDS FOR PHOTOGRAPHY AND MOTION PICTURES

J. W. McNair
American Standards Assn.

A brief review of the work of the ASA War Committee on Photography and Cinematography, Z52, in the preparation of dimensional standards, test methods, procurement specifications, etc., for still and motion picture equipment and materials with especial attention to the work accomplished since the October, 1944, SMPE Technical Conference.

A THREE BAND VARIABLE EQUALIZER

L. D. Grignon
20th Century-Fox Film Corp.

A recently designed variable equalizer providing suppression and emphasis in three frequency bands, adjustable by means of three controls and based on a different philosophy, is described. The principle features include: (1) zero insertion loss; (2) small change in apparent insertion loss as equalization is varied, and (3) more pronounced effects for equivalent changes in equalization.

POSITIVE VARI-FOCAL VIEW FINDER FOR MOTION PICTURE CAMERAS

Frank G. Back, M. E., Sc. D.
Research & Development Lab.

Vari-focal view finders now in use change the field which corresponds to the field covered by the camera lens either mechanically or optically. Mechanical systems change the area of the image seen through the view finder and therefore produce small images when used with telephoto lenses. The optical view finders now in use are either negative systems which do not allow the image produced by them to be framed properly, or they also change the area of the image.

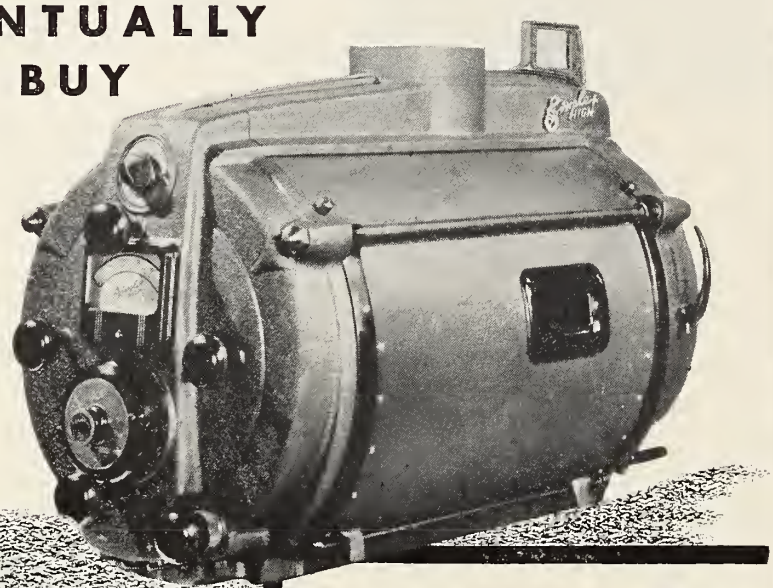
The new view finders consist of a variofocal system with movable lenses producing real images corresponding to the different fields of the motion picture lenses at infinity which is viewed through a stationary erector system. It therefore can be framed and the frame being inside the erector system always appears the same size regardless of the focal length of the view finder.

THE ACOUSTICAL PROPERTIES OF FIBERGLAS

Willis M. Rees and Robert B. Taylor
Owens-Corning Fiberglas Corp.

The wide range and controllable properties of Fiberglas thermal insulating materials when used as absorbents of airborne sounds are discussed. Tables of sound absorption coefficients are given for six frequencies from 128 to 4096 C.P.S. and

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for twenty-four different combinations, weights, and thicknesses of materials. Curves are shown analyzing the relative absorption at different frequencies of the different materials based on density, thickness, and fiber size.

Sound isolation blankets made of a newly developed superfine glass fiber show remarkable acoustical efficiency when used for aircraft sound insulations. Their potential application to other uses when materials and research facilities are available is discussed. Some data are also given evaluating the influence of surface treatments and enclosing materials and methods.

The paper is a compilation and analysis of available data but does not represent a complete evaluation since much further work is needed as a result of properties discovered in war applications.

MACHINE PROCESSING OF ANSCO COLOR FILM

J. L. Forrest
ANSCO

Ansco Color 16-mm motion picture film has been manufactured for several years. The bulk of the production has been used by the Armed Forces. In field operations, hand methods of developing have been used. However, for first-class results an especially-designed processing machine is recommended. Such machines have been constructed by Ansco and in this paper the author describes the design and use of these machines.

WAVE PROPAGATION AND OUTDOOR FIELD TESTS OF A LOUD SPEAKER SYSTEM

F. L. Hopper and R. C. Moody
Western Electric Co., Inc.

This paper discusses data and observations made with a loudspeaker system outdoors with regard to sound transmission as affected by such factors as: wind, temperature and humidity. Other data is given on measured and computed sound pressure distribution characteristics of multiple element radiators.

A PUBLIC ADDRESS AND SOUND RE-ENFORCEMENT SYSTEM FOR THEATRES USING THE DUPLEX LOUDSPEAKER

J. B. Lansing
Altec Lansing Corporation

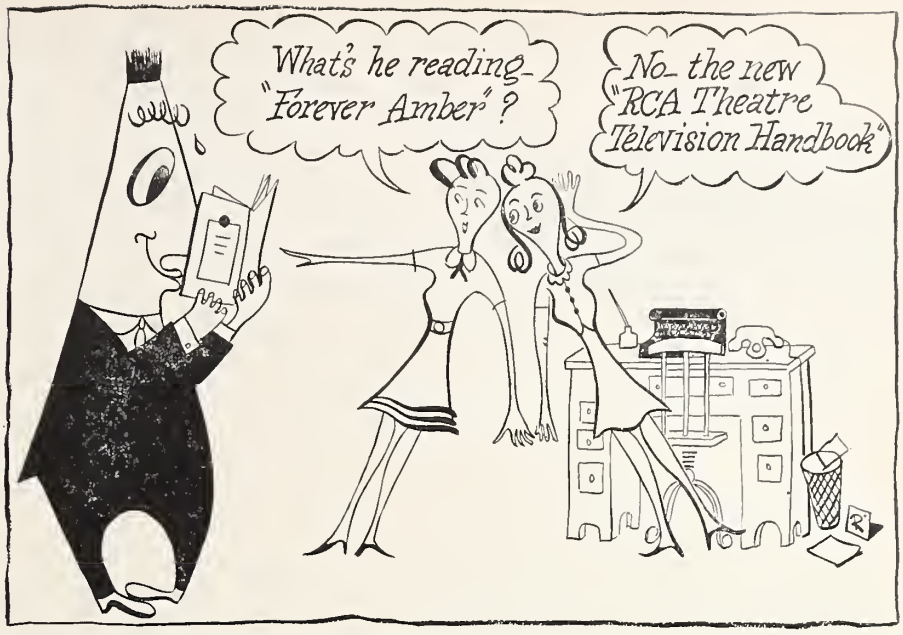
The permanent magnet type duplex loudspeaker and its use in theaters for sound re-enforcement is described in this presentation. Its efficiency and frequency response is shown. Special types of baffles for the sides of the stage and above the screen are described. Because of its high efficiency and wide angle of distribution and extreme frequency range along with its small physical size, it provides a two way horn system with many advantages over those in present use.

FILM: THE BACKBONE OF TELEVISION PROGRAMMING

Ralph B. Austrian
RKO Television Corporation

Based upon several years experience in producing live talent shows, facts and figures will be presented to show why film and film techniques are better suited than live talent, for the great majority, perhaps 60% or 70%, of television studio programs.

Also shown will be the tremendous in-



THE RCA Theatre Television Handbook may not be as exciting as a "best seller," but you will be vitally interested in learning the what, how and why of theatre television from the booklet's timely articles and discussions.
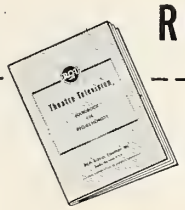
The Handbook was designed for projectionists, but also contains news of television developments of interest to exhibitors and theatre managers — such as television reception and large-screen projection. There are chapters dealing with the commercial possibilities of television, handling of programs, audience response.

RCA's television experience is backed by a quarter century in the field of electronics and includes television installations at the New York World's Fair in 1939, and demonstration large-screen television projection at the New Yorker Theatre in 1941. This new book is offered by the RCA Service Company as an aid to projectionists and exhibitors in preparing for the advent of theatre television.

Send for your free copy, today! Address: RCA Service Company, Inc., Box 70-178M, Camden, New Jersey.

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ANALYSIS OF THE COMPARISON OF BEAM POWER AND TRIODE TUBES USED IN POWER AMPLIFIERS FOR DRIVING LOUDSPEAKERS

J. K. Hilliard
Altec Lansing Corporation

This paper is a description of a study of two types of output power tubes used to drive loudspeakers. Since the introduction of beams power tubes several years ago, engineers have not been in agreement that it gave comparable results to the low impedance triode type tubes. The comparison was made on 15 and 40 amplifiers. The results indicate how both types of tubes can be made equivalent and intermodulation curves on all amplifiers are shown. Signal to noise ratios are also given.

PUSH-PULL FREQUENCY MODULATED CIRCUIT AND ITS APPLICATION TO VIBRATORY SYSTEMS

A. Badmaieff
Radio Corp. of America

This paper describes a new push-pull frequency modulated circuit in which the push-pull action is accomplished by varying the resonant frequencies of both the oscillator and the discriminator in opposite phase relation to each other. Modulation of the oscillator and discriminator is achieved through the use of two capacitors with a common plate and arranged in a push-pull circuit. Thus if the common plate is the moving element of a vibratory system, this circuit can be used for measuring vibrations or for monitoring purposes.

One of the applications of the push-pull FM circuit is to calibrate recording heads while cutting phonograph records. Using this calibrator, it is possible to measure, without mechanical or inductive coupling, the actual frequency response of the cutting head under normal load and to observe the input-output characteristics as well as the amount of distortion. It is also possible to use it for monitoring, while recording.

ORGANIZING 16-MM PRODUCTION

Lloyd Thompson
Calvin Company

Production by 16-mm methods lends itself to good business practices. This paper describes the organization, production, and facilities utilized by The Calvin Company in Kansas City—so far as is known, today's most integrated, inclusive 16-mm concern. The standardization of certain methods, procedures, and equipment are explained. The general layout of these facilities, floor plans, and some special equipment are shown.

THE FILING AND CATALOGING OF MOTION PICTURE FILM

Carl M. Effinger
20th Century-Fox Film Corp.

The improved methods of cataloguing and filing motion picture film are described. While very compact, the film catalogue system permits very rapid location of a single frame of the desired shot. An elaboration of this system has been put into use by the United States War Film Index Library.

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TELEVISION DEVELOPMENTS

(Continued from page 16)

images which blend into a motion picture on the screen.

Scophony has developed these two different methods of modulating a similar light so that the degree of enlargement and the intensity of the light on the screen is really a function of the light source and the optical system.

The Skiatron system is more newly developed and has not yet been entirely perfected. It is believed, however, that development work during the war period, about which much cannot be said, will result in rapid perfection in the post-war period. Dr. Rosenthal discussed many of the problems inherent in satisfactory presentation of large television images in theatres as they compare and contrast to the presentation of motion pictures, and pointed out that in his opinion the use of such systems as Scophony has developed more adequately meet some of the important requirements than do other methods discussed, which involve the enlargement of a bright image on a fluorescent screen.

One of the important problems to be considered in this latter arrangement involves the relative efficiency of the fluorescent screen as well as the efficiency of the enlarging optical system, plus the very important inherent limitation of the total light emitted by the fluorescent screen.

It is entirely possible, therefore, that when theatre television is finally introduced on a broad scale, it may be accomplished by projection of modulating images from very bright arc lamphouses through highly efficient optical systems rather than attempting to enlarge fluorescent screen images. If this is true, there undoubtedly will be other methods of accomplishing this in addition to those described by Scophony. At least one of these other methods, as well as the two Scophony systems were described in two installments of a series published some time ago in the INTERNATIONAL PROJECTIONIST, entitled "Television Today."[1]

SMPE Tele Committee

The Society of Motion Picture Engineers is thoroughly conscious of the approach of theatre television and recognizes that with its introduction there will he a great many problems which will affect theatre construction and operation. The Society has, therefore, in its reorganization of the Theatre Engineering Committee, created a Subcommittee on Television Projection Practice. This Committee will consist of representatives of nearly every phase of the industry, who will, in the near future, make a thorough study of all the problems in the theatre which will be effected by the introduction of television. Recommendations will be made to the industry for the adoption of recommended practices to cope with all the ramifications inherent with the addition of theatre television to the motion picture presentation with the least possible confusion and expense.

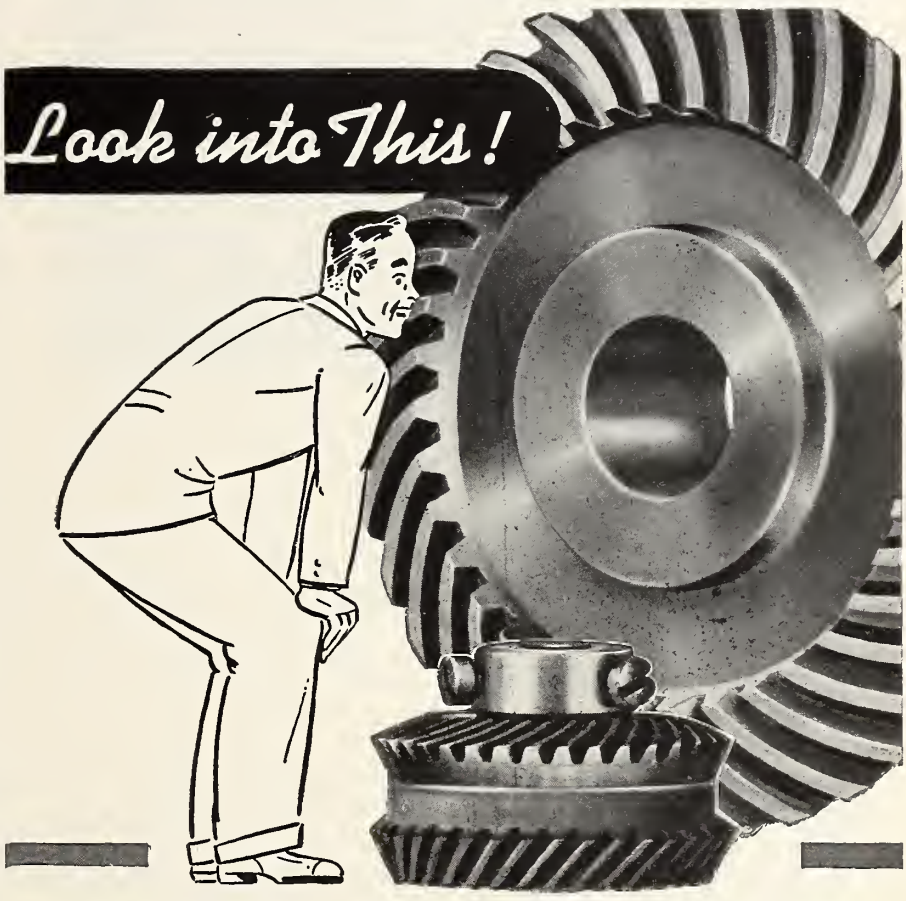
1 "Reproducers," Part 1. June, 1944; Part 2. July, 1944.

ATLAS CORP.'S PICTURE HOLDINGS ARE $13,140,448

Amusement securities held by the Atlas Corp. as of Dec. 31, 1944, were valued at $13,140,448, according to the annual report to stockholders by President Floyd B. Odlum. Of this figure $12,662,273 are of RKO holdings. For the previous year film securities of the corporation amounted to $17,112,621.

Mr. Odlum, in commenting upon RKO Corp., said the company "had a profitable year in all main branches of its business, although its earnings available for stock were below like earnings of the year 1943. This decrease in earnings available for the stock of 1944 was not unexpected because the 'loss carry over' which that company had available to it under the provisions of the Federal Income Tax Law was used up during the year 1943 and because the profits from the production of pictures in Hollywood before taxes were substantially below the record high profits from this source in 1943."

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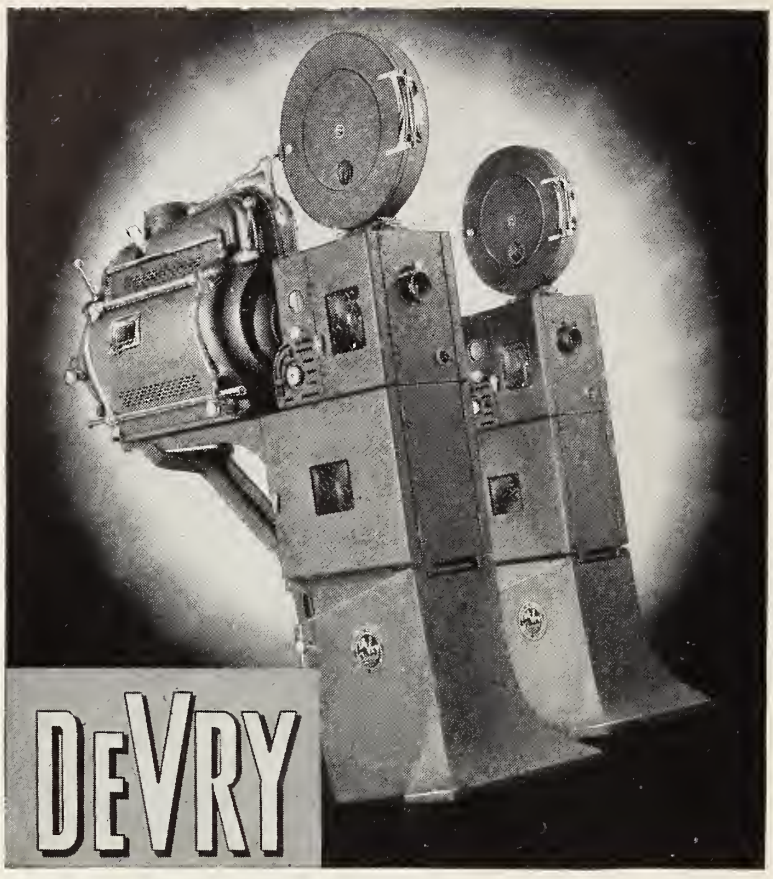
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IN THE SPOTLIGHT

(*Continued from page* 15)

"Oklahoma," writes a touching letter about his experiences with the show in Dutch New Guinea.

"Our show," says Solly, "opened with a bang—the boys loved it. They certainly do crave entertainment in this hell hole. Despite the fact that the theatres out here are all outdoors and it rains every other night, we do not miss a performance. Wet and slippery stages do not stop the cast from putting on as good a show as possible. The deep and sincere appreciation of the men for our kind of entertainment is all the encouragement needed to spur the entire company to do its level best. . . ."

The above letter was followed several days later by another one from the Philippines, where the unit plans to remain for some time. Our friend Solly sure is getting around.

● The request of Minneapolis Local No. 219 for a 5% wage increase plus pay for preparatory time mentioned in these columns last month, has been rejected by the independent exhibitors of that city. The dispute will now go before the state labor conciliation board for arbitration.

● Tom Shea, I. A. representative and business agent of Local No. 375, Middleton, Conn., has been appointed chairman of the committee of Connecticut I. A. projectionists in the 7th War Loan Drive.

● Milwaukee Local No. 164 is the latest I. A. local union to come under the banner with the other progressive locals who are conducting television classes for its members. Business agent Otto Trampe announces that members are now registering for the television course which is expected to open very shortly

● The good neighbor policy actually works in Local No. 656, El Centro, Calif. Under the direction of business agent, R. W. Barrigan, the local played host to Pedro, a famous and popular Mexican star. At the request of the theatrical union in Mexico, the local provided for the star's transportation to Tia Juana where he appeared in a benefit show for the Mexican Red Cross.

TRACY REPRESENTED LABOR AT PEACE CONFERENCE

Daniel W. Tracy, Assistant Secretary of Labor, was named as the United States Department of Labor advisor to the American delegation at the San Francisco peace conference. Mr. Tracy, who received his labor appointment through the late President Roosevelt, was the first official labor delegate sent by the United States to the International Labor Office Conference in Geneva in 1935. This also was a Presidential appointment, as was that of labor representative to the Pan American Conference in Peru in 1938.

AT YOUR SERVICE

(*Continued from page* 21)

cases are already grounded back through their own conduit to the frequency charger.—J. H. HEWSON, *Dominion Sound Equip., Ltd.*

Improving Operations of Take-Up

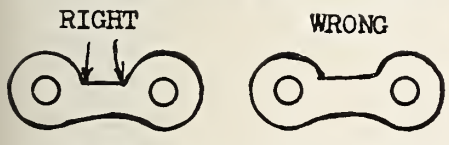
Any equipment having take-up trouble with a take-up using a leather friction disc can be corrected by removing this disc and substituting it with one made of hard pressed cardboard. When the cardboard disc is installed cover it with oil and wipe off the surplus oil. This type of friction disc will give an even tension on the film from start to finish of the reel and will not tear out sprocket holes in the film when the projector is started. After the initial adjustment is made it requires no further attention. Projectionists who have tried this type of friction disc claims that it works more satisfactorily than the leather disc.—A. N. KIDWELL, *RCA.*

Checking Fuses in Power Units

A quick way to check fuses and capacitors in the exciter lamp power supply units of all types of equipment is to turn up the gain of the amplifier to its full capacity, then switch the sound to one machine and open the fuse in the power unit on that machine and listen for a change in hum. Switch to the other machine and repeat. This check will be found to be quick and thorough. —A. H. CLOW, *RCA.*

Trouble in TA-7260-B Aperture Corrected

Occasionally I get a complaint of trouble on the WE TA-7260-B aperture on which one of the E-3 film pressure pads will slip sidewise and catch so that



it does not ride smoothly on the film. This usually is due to the use of the incorrect part as the inner guide. The correct part has a narrow notch in the center to prevent it from sliding in on the outer part of the retaining bar. (See the illustration above.) If necessary, this part can be made from the outer guide by grinding or filing off excess metal.—B. D. DOUGLAS, *RCA.*

Operating RCA PS 24 Soundhead With Broken Pad Roller Arm

To lessen the possibility of film damage when the bottom arm breaks and no spare is available, the remaining part of arm and screw and lower sprocket can be removed and the film run directly from the constant speed sprocket to the lower magazine. The film will miss the sprocket shaft. If the top arm breaks it is best to replace it with the lower arm and operate as outlined above.—R. H. BISBEE, *RCA.*



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Use of Copper Wire Strands for Emergency Fusing

WHEN some electrical trouble causes the repeated burning out of fuses, the theatre's supply of spares may be exhausted before the source is discovered.

To avoid this, copper wire strands of correct diameter or gauge may be used as temporary fuses, if the apparatus arrangements are such that burning out of these strands can do no harm. Copper strands can also be used, with safety, as emergency refills in the refillable type fuses.

The size strand to use in each such instance is given in the following tables but it must be understood that these figures are only very approximately reliable. Many factors will vary the exact fusing point of a wire. Some of these factors are: ambient temperature, purity of the copper in the particular wire used, annealing or other treatment the copper has undergone, and the extent to which the surface has oxidized or otherwise corroded.

TABLE A

Fusing Current	*Wire Gauge**
1 amp.	43
3 "	37
5 "	34
10 "	30
15 "	28
20 "	26
30 "	24
60 "	20

The figures in Table A must never, of course, be confused with the carrying capacity of wire conductors; they represent the approximate current at which the wire will burn out *instantly*. A slightly smaller current will burn out the wire over a somewhat longer period of time. The *safe* carrying capacity of wires is very much lower.

If the projectionist does not have a suitable wire gauge with which to measure strands of the sizes referred to, he can refer to a micrometer and Table B.

Stranded copper wire of larger gauge is one source for the strands necessary. Unfortunately, manufacturing standards are not constant, and it is therefore not possible to assume that one strand taken from a given size stranded wire will be of the gauge required. Each strand must be gauged or miked.

TABLE B

Wire Gauge	*Diameter*
43	.0021 inches
37	.0045 "
34	.0063 "
30	.0100 "
28	.0126 "
26	.0159 "
24	.0201 "
20	.0320 "

Projectionists will remember that almost everywhere in the United States, where there are any regulations at all governing projection room practice, open fusing is forbidden; but there is considerable latitude is most localities with respect to the use of open fusing inside totally enclosed apparatus. In such circumstances, the only other question the projectionist has to consider is whether the nature of the apparatus, and the location of the fuses, are such that a little spattering of molten copper when the wire gives way can do no injury, cause no short circuits. If the wire strand is to be used inside a refillable type fuse, as an emergency refill, of course it may be used safely and legally anywhere.

Because of the highly approximate nature and relatively low reliability of the tables given above, projectionists should never rely on strand fusing as a substitute for keeping a full supply of spares or refills in the projection room. But on the other hand, in the case of an obstinate trouble that is blowing fuses repeatedly, the projectionist would be well advised *not* to risk exhausting his supply of spares. He will do better to resort at once to strand fusing, wherever possible, legal and safe, until the trouble has been eliminated. Then the strand fuse should be removed without fail, and a regular fuse reinserted.

* American Wire Gauge.

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The ASSOCIATED ELECTRONIC ENGINEERS

Altec Adopts Pension Plan for Employes

THE establishment of a retirement ment pension plan has been announced to employes by the Altec Service Corporation, which has been passed and approved by the board of directors and stockholders, and Treasury Department approval given. Under the plan an employe is eligible for retirement at the age of 60 (females age 55), provided the employe has twenty years or more of service.

A feature of the plan, provided to protect those of its employes who have devoted many years of service in the sound motion picture field and who otherwise might be unable to complete twenty years of service with Altec, approval has been secured for the granting of past service credit for services rendered by those previously employed by Electrical Research Products, Inc., and who transferred to Altec upon its formation in December 1937.

G. L. Carrington, president, in announcing the plan, said that "ever since its formation Altec has realized the importance of providing protection and security not only for its customers but for its employes as well. Early in its history a group insurance plan was inaugurated. Later group hospitalization was added, including surgical benefits."

Entire cost of the plan is being assumed by Altec, with the program providing a retirement income equal to about 25 per cent of present salaries.

REISKIND NAMED CHIEF ENGINEER OF VICTOR RECORD DEPT.

H. L. Reiskind has been appointed chief engineer of the record department of RCA Victor Division, according to J. W. Murray, general manager of RCA Victor record activities. He formerly was record research and advance development engineer for the RCA Victor plant in Indianapolis.

Mr. Reiskind, since joining RCA in 1936, has been engaged in extensive engineering work in connection with recording and sound reproducing equipment in the Camden, New York, Hollywood and Indianapolis plants and studios. As chief engineer of the record department he will make his headquarters in Camden.

BELL & HOWELL CO. DECLARES DIVIDEND ON NEW STOCK

An initial dividend of 45 cents per share has been declared by directors of the Bell & Howell Co., Chicago, on its new cumulative preferred stock, 4¼ per cent series, for the period from date of issue of this stock to June 1, 1945. The directors also declared a dividend of 12½ cents per share on the new common stock, payable June 1, 1945. J. H. McNabb, president, reported that the earnings of the corporation for the first quarter of 1945 amounted to $1,138,991.69 before Federal taxes and renegotiation. This compares with $859,826.15 for the corresponding period last year.

LOEW'S NET IS $14,517,256

Loew's, Inc., and subsidiaries, for the fiscal year ended Aug. 31, 1944, report net income of $14,517,256, an increase of $1,094,403 over the net profit of the previous fiscal year. The latest net income was equivalent to $8.61 per share on the 1,685,109 shares outstanding, compared with $8.01 on 1,675,213 shares outstanding in the previous year. Operating revenue totaled $165,939,527, while Federal income taxes amounted to $8,103,346. Excess profit taxes were $4,837,579.



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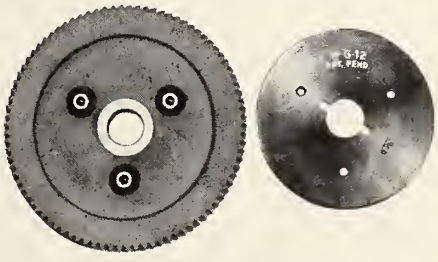
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SIR AMBROSE FLEMING could hardly be called the inventor of the vacuum tube, yet that most remarkable of electrical contrivances certainly would have been impossible without the pioneering work he did before scientists knew anything about electrons.

With him passes a distinguished figure in the history of radio. The technical success of the early Marconi system of wireless telegraphy owes much to his introduction of the "diode," which was the forerunner of our vacuum tubes and the offspring of Edison's incandescent lamp.

Both Edison and Sir Ambrose wondered why bulbs blacken. Both decided that something was boiled off from a filament and deposited on the glass. Edison sealed a plate in the bulb, connected it with an independent battery and found that a current streamed over the empty space between the filament and the plate. Both men were struck by the fact that the current flowed in one direction only and that it could not be reversed.

Sir Ambrose saw at once that a modified lamp might act as a "rectifier;" that is, as a means of suppressing one-half of an alternating current's oscillations, to give a flow in one direction only. The opportunity to apply the principle came when Marconi made Sir Ambrose the chief engineer of his company. He used his old rectifier as a detector with success. It only remained for de Forrest to introduce the grid and thus make the vacuum tube a highly sensitive device which could turn a stream of electrons on or off.

FIFTH ARMY-NAVY "E" AWARD MADE TO DeVRY CORPORATION

The fifth consecutive Army-Navy "E" for continued excellence in the production of motion picture sound equipment and secret electronic training devices for the armed forces has been awarded to the DeVry Corporation, Chicago. Previously the only manufacturer of motion picture sound equipment to have been awarded four consecutive "E" citations, DeVry now joins the select few among the nation's producers of vital war goods privileged to fly the coveted 5-star banner.

CARPENTER RETURNS TO ALTEC IN ENGINEERING POST

T. H. Carpenter has returned to the Altec Service Corporation as development and design engineer, according to an announcement by C. S. Perkins, manager of commercial engineering. Mr. Carpenter, who was on special leave to the Columbia University Division of War Research at the United States Navy Underwater Sound Laboratory, Fort Trumbull, New London, Conn., as development engineer, is a former ERPI engineer, and has been associated with Altec Service Corporation since its formation. He is a graduate of the Massachusetts Institute of Technology.



RCA TELEVISION HANDBOOK NOW AVAILABLE

The booklet, "Television Handbook for Projectionists," which RCA is distributing without charge to projectionists and all others in the industry contains interesting useful information on systems that may be introduced for theatre use as well as some fundamental information on electronics, in addition to some general hints on how to operate and maintain theatre television systems.

It is clearly stated in this work that it is impossible at this time to forecast the type of equipment that will be available for theatres in the postwar period. But based on present information, the booklet certainly does a fine job for the projectionist. It is assumed that in the postwar period when we more definitely know what equipment will be available and what conditions of operations will prevail, RCA will bring out its second edition of this very interesting booklet.

MAYER APPOINTED ASSISTANT TO RED CROSS CHAIRMAN

Arthur L. Mayer, previously an assistant coordinator of the war activities committee of the motion picture industry, and a film consultant to the Under Secretary of War, has been named an assistant to Basil O'Connor, chairman of the American Red Cross. Mr. Mayer since last fall has served the Red Cross as deputy commissioner of the Pacific Ocean area, with headquarters in Honolulu, and recently returned to this country. He will leave soon for an extended European tour to study opportunities for additional Red Cross service to the armed forces following V-E Day.

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PROJECTIONSTS' SERVICE MANUAL is a compilation of "At Your Service" items published in I. P. during the past few years and is now brought out in handy book form. All items are grouped according to their classifications and contain sound practical suggestions relating to the many projection room troubles — their causes and how to remedy them. Diagrams and sketches illustrate many of the suggestions offered.

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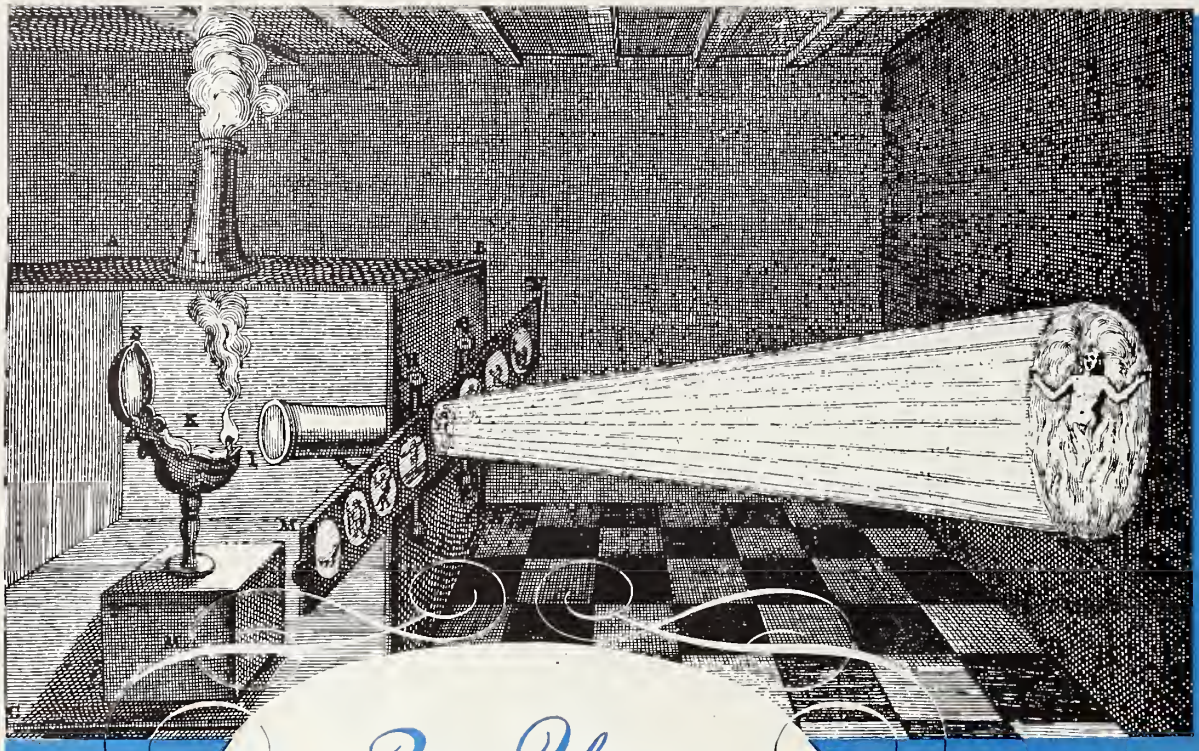
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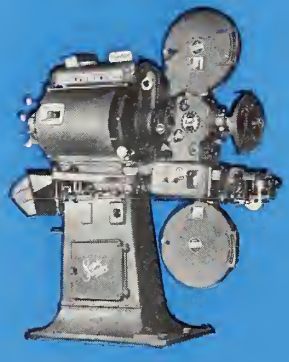
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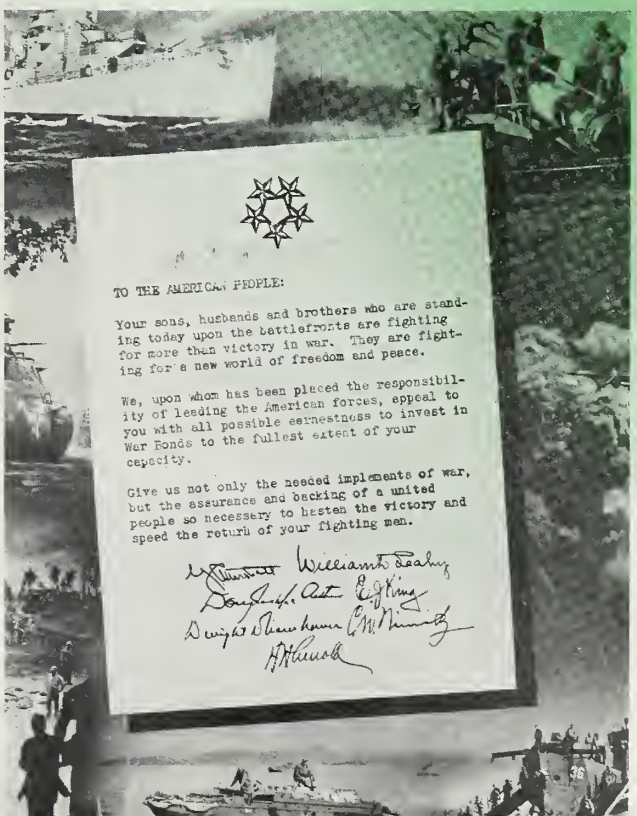
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JUL 4 - 1945



JUNE 1945

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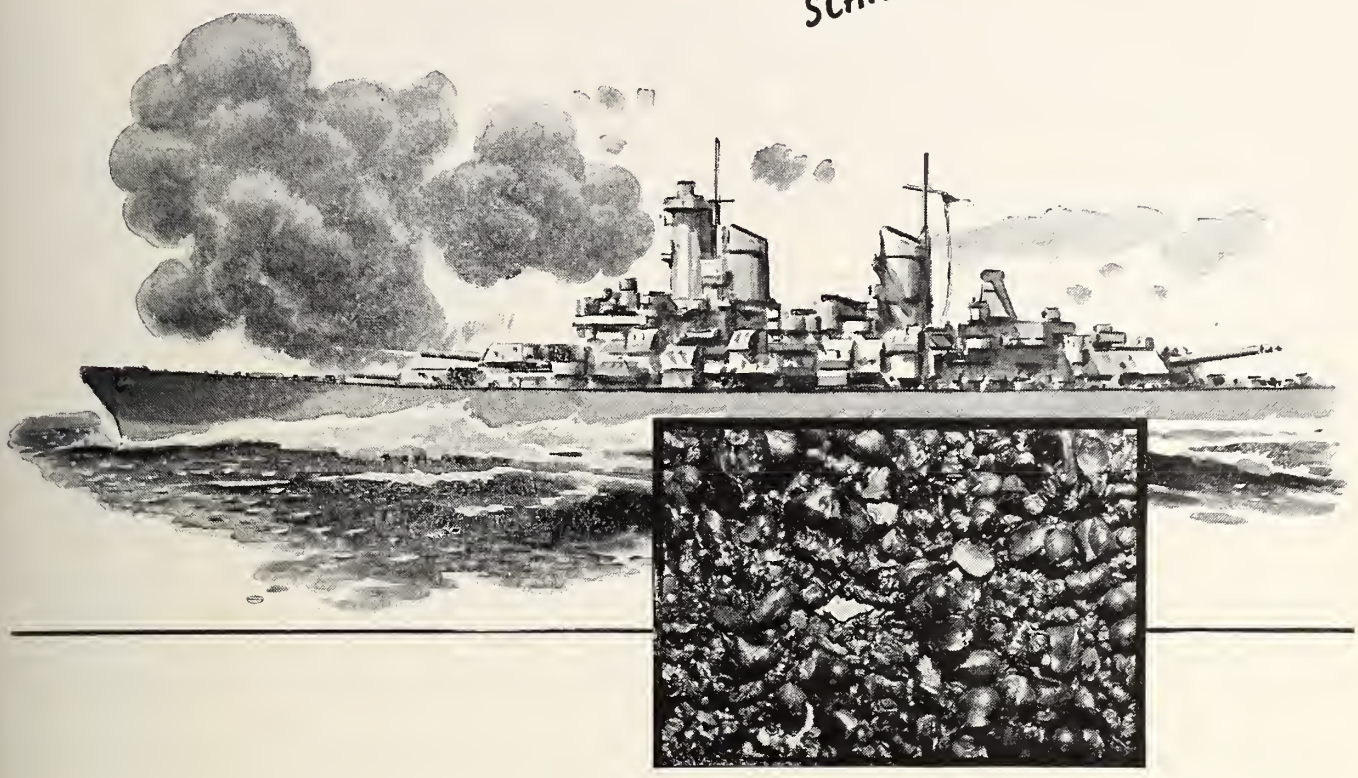
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With Which Is Combined PROJECTION ENGINEERING

W. L. Lightfoot, *Associate Editor*

Volume 20 JUNE 1945 *Number* 6

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MONTHLY CHAT

THE man who keeps the show running day in and day out is the projectionist, who, high in his projection room, sadly is an unsung but highly important craftsman. But upon his shoulders falls every detail of the smooth-running programs that mark the skilled technician.

As a matter of fact, the only man among all the personnel of a theatre who is at all technically-minded is the projectionist. The theatre owner and the manager know all about the architectural beauties of the house, personally pick out the paintings and other art objects on display, and can call off at a moment's notice the exact fiscal level of any day's proceeds, but they lack the knowledge of knowing what equipment and accessories are needed to keep the show going—the most important operation of every motion picture theatre.

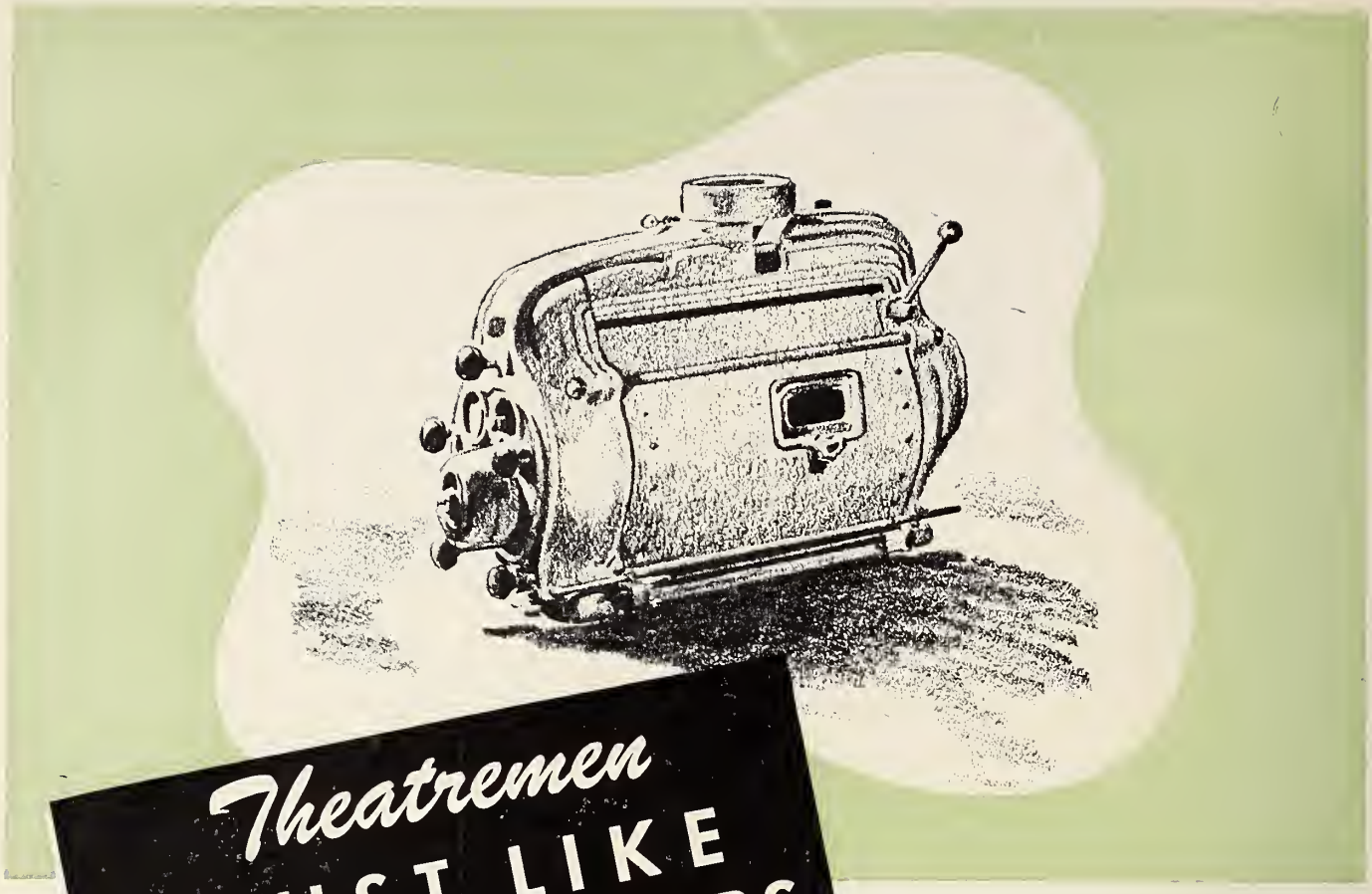
The result is, of course, that the projectionist is the man who makes the decisions when replacements or new equipment is under consideration. The theatre owner or manager may talk to the equipment salesman; they may nod their heads knowingly—but when it comes time to sign on the dotted line the projectionist is called in to give the answer. His "yes" or "no" makes or breaks a sale, and this is as it should be because, as already has been said, he is the only man in the entire operating organization who has the slightest idea of the practicability or impracticability of equipment as pertaining to a particular theatre's individual problems.

Equipment manufacturers naturally realize these facts, and while their representatives contact those beyond the projectionist they wisely also see to it that the projectionists are apprised of the A. B. Cs of their products.

INTERNATIONAL PROJECTIONIST is the only trade publication which reaches practically every projectionist in the country, and through its columns alert manufacturers for years have told their story to the man upon whose decision rests the sale. They realize it is the quickest and soundest medium available through which to reach the man who must be sold.

• • •

An interesting study is published by the Department of Commerce's Industrial Reference Service, on motion pictures and equipment, the survey bringing out the post-war market potentialities, covering the requirements of several foreign countries. Detailed information is given for post-war needs in Gibraltar, Spain, Turkey and Russia. The study, which is Part 3 of the Industrial Reference Service for April, may be secured by addressing the Superintendent of Documents, Washington, D. C., or the department's field offices.



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VOLUME XX JUNE 1945 NUMBER 6

Operation and Maintenance of the Filmosound V 16-mm Projector

By *AARON NADELL*

Continuing its promised presentation of operation and maintenance details of 16-mm equipment, I. P. herewith offers an account of the Bell & Howell "Filmosound V" projector. Step-by-step analysis of the schematic of the amplifier used with this projector will appear in a future issue.

FIGURE 1 shows the 16-mm apparatus which is the subject of this month's presentation threaded and ready to operate, except for the fact that the speaker has not been properly positioned. The speaker is shown in the carrying case at left, rear, of the illustration, and is used exactly as there shown, with the rear door of the case closed. It is customarily placed under the center of the screen, although special local conditions may make a different position preferable. It connects with the projector proper by flexible cable, which should be so run that the audience will not trip over it.

Two speakers, however, can be used with this projector, and there are two speaker terminals on the projector—on the side away from the reader in Figure 1. These terminals offer a choice of two different impedances; connection is made to one terminal or the other, according to the number of speakers, not to both terminals simultaneously. Output impedances are eight and sixteen ohms.

The apparatus shown is made for operation with a line power supply of 115 volts, 50-60 cycles, but it can be obtained in a model suited to d.c. lines also, and for 25-60 cycle a.c., or with an external rheostat for use with 220-volt power supplies. Power cable connections vary slightly according to the type of power for which the apparatus is equipped.

A spare drive belt is shown stretched across the top of the opened projector door in Figure 1; below this is an open compartment for lubricating oil, fuses, and spare exciter lamp; extending rightward from the bottom of this compartment is a brush adapted to cleaning the projector aperture. Directly below the brush is the receptacle in which the reel arms are secured when the apparatus is in portable condition.

The real arms are suitably marked "top" and "rear," and are attached in operating position by means of thumb screws. The spiral spring drive belts are then looped into place. The pulley, *P*, that drives the rear belt is shown in Figure 1. The reverse belt, used to drive the front pulley when film direction is reversed, is visible in Figure 1 as two parallel white lines which extend in exactly the same direction as the first reel arm downward into the projector and disappear behind the gear case. Reels are pressed onto the spindles of the reel arms, and snap into place. They are carried in the speaker case.

The speaker is properly positioned, and a protective grill cover (not shown in Figure 1) is removed for operation. The projector is placed on a suitable table so related to the screen that the heads of the audience do not intercept the light beam; it is moved forward or back, left or right, until the image of the aperture occupies the desired position and size upon the screen. This operation is performed before film is threaded, but with the projector light and motor switched on.

Light and motor switches are shown at lower left of the projector, Figure 1. The lens is focussed by means described hereafter until the image of the aperture

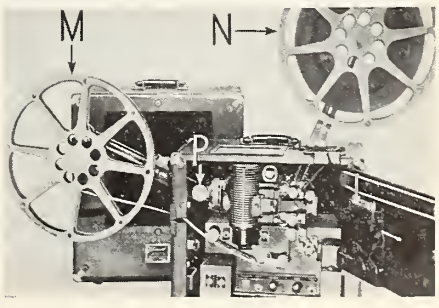


FIGURE 1

is sharply outlined. The focus is not locked down at that time. The amplifier is switched on, and film threaded. The projection lens is refocussed when the first title appears on the screen, and the focus then locked.

Details of Figure 1

The projection reflector is seen just right of the pulley in Figure 1. A large hand-knob located between pulley and reflector, and not visible in the illustration, is turned counter clockwise to remove the reflector for cleaning. The ridged, upright cylinder, just right of the reflector, is the lamphouse. The ridges or flanges help dissipate the heat of the lamp. Just right of the top of the lamphouse is a pilot lamp cover. The lamp is operated by pulling the cap toward the reader; snapped off by pushing the cap inward again. The cap is removed, when the lamp needs replacing, by turning it counter clockwise.

The two projection condensers are located below this pilot lamp. Two small studs are clearly visible in the drawing. By grasping those studs the condenser holders are readily pulled out for cleaning. In line with those studs and a little right of them is the lens locking screw.

At the base of the corrugated lamphouse is a cap which unscrews and allows the projection lamp to slide downward for replacement. The lamp mounting includes a metal centering ring which, while in operating position, picks up heat from the lamp and passes it on to the flanged housing, therefore remaining comparatively cool itself; but the instant the lamp is removed this centering ring can no longer pass on heat to the housing and consequently heats up very quickly. A hot lamp in process of removal is grasped by this centering ring and then laid down at once before the ring becomes too hot to handle. Current, of course, is switched off before any step is taken toward cleaning a lamp.

These lamps are prefocussed, and the manufacturer asserts that they therefore give 15 percent more screen light. Standard size is 750 watts, but 1,000 watt lamps

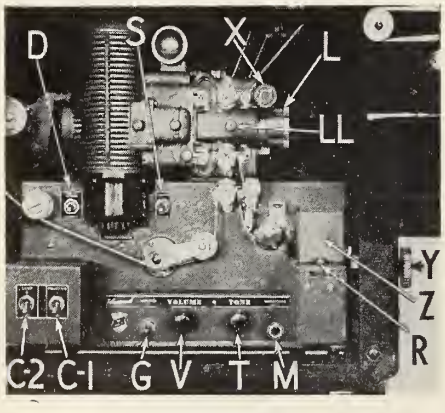


FIGURE 2

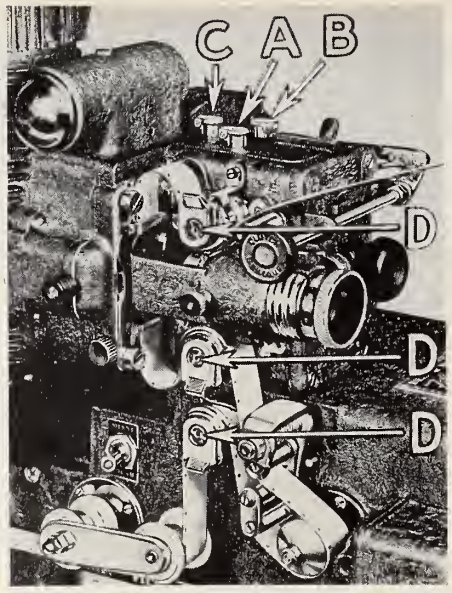


FIGURE 3

are also available. A tongue which is part of the centering ring fits into a slot at the bottom of the lamp house to assure correct positioning of the lamp. When the screw cap is replaced and screwed down squarely (without cross-threading) the newly installed lamp will be locked in perfect focus alignment.

Additional details are seen clearly in Figure 2. At the upper right, showing a corner of the opened inner door, note one of the spools holding the spare belts and the aperture cleaning brush.

At right, toward the top, the pulley, *P* of Figure 1, can just be seen. The motor reversing switch, *D*, may be seen in Figure 2. As shown, the toggle is down for normal projection. Switch *D* permits film to run backward through the projector. Since it is possible with this mechanism to project one frame at a time as in strip projection, switch *D* facilitates running backward through a number of frames to project again one previously shown. It is not used for rewinding.

Adjusting the Projector

Provision also is made for projecting silent films, with or without sound accompaniment by means of microphone or phono turntable. Switch *S* in Figure 2 is shown set for sound projection, but with the toggle upward the mechanism will operate at the silent speed of 16 frames per second, instead of 24 frames per second.

Toward top right of Figure 2, is a clutch control, *X*. Turned counter clockwise as far as it will go, it disconnects the projector mechanism from the motor, but not the reel drives. Hence this clutch is disengaged for rewinding, and for still projection. It is re-engaged for normal projection by turning it clockwise.

LL is the lens focus locking screw; *L* is the knurled end of the lens barrel which permits focussing both by moving the lens in and out for coarse adjustment and revolving the knurled knob for fine adjustment.

Y in Figure 2 adjusts the tilt of the projector upward or downward; *Z* is the exciter lamp cover, and *R* is a jack into which is plugged a special cable that runs to a remotely located volume control. The jack used for microphone or phono input is indicated by *M*, and *T*, the tone control, is shown to its left. *V* is the volume control, and the amplifier power switch is shown as *G*. The device just left of *G* is the Bell and Howell insignia.

Threading the Film

Figure 3 shows film threaded in place. Just behind the top loop a loop size guide can be seen embossed on the gear case. A similar guide indicates the correct size of the lower loop.

Just right of the lens is a black knob by means of which the mechanism is hand operated. It is used in threading and in still projection. Turning this knob clockwise through several revolutions will cause the claw to engage the sprocket holes and move the film. The permanence of the loops is tested in this way after threading; if either loop diminishes in size it is re-made and again tested with the hand knob. In still projection this hand knob is used, if necessary, to get the shutter out of the path of the light.

Below and just right of this knob, between knob and lens, there is a lever, imperfectly shown in the illustration, which opens the gate for threading and for removing the gate shoe. With the gate open, the shoe is simply withdrawn, without tools, and both shoe and the rear of the lens are then accessible for cleaning.

In Figure 3 the lamp housing is clearly visible. Just right of the housing, a bit below the top of it, is the cap of the pilot lamp. Directly below the cap, and left of the center of the gate, is a ribbed hand knob by which one of the condensers can be drawn out for cleaning. (The corresponding knob for removing the other condenser can barely be seen, straight left.) Diagonally right and downward from the fully visible condenser frame

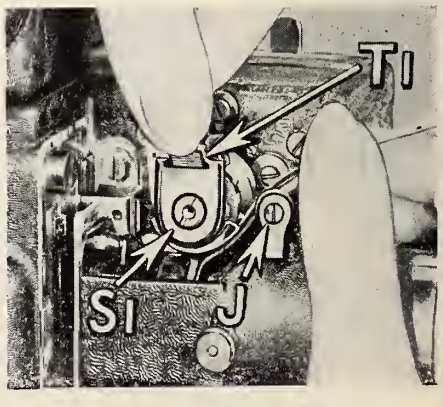


FIGURE 4

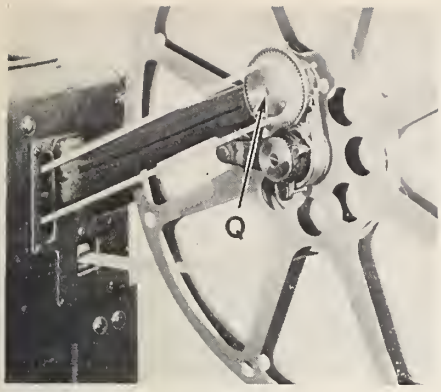


FIGURE 5

hand knob, and similarly facing the reader, is the knurled framing knob. It is directly above the silent-sound switch, and left of the lower loop.

A, *B*, *C* and the three points, *D*, in the illustration, are lubrication points and will be referred to hereafter.

Figure 4 illustrates an important detail of the process of threading. The sprocket roller is shown as *J*, and *S1* is the sprocket. *T1* is the tab of the sprocket guard. The left thumb in the illustration is pressing down on the tab. This opens the sprocket guard and permits insertion of the film around the sprocket, and engaging of the teeth in the sprocket holes. When the tab is released the guard snaps back into place. In Figure 4, which shows the upper sprocket, the tab points upward. Figure 3 shows that the lower sprocket and the sound sprocket have similar guards, but with their tabs extending downward. Their operation, however, is the same.

Part of the pilot lamp cap can be seen at upper right in Figure 4; below it the forward condenser ribbed removal knob is plainly visible; and diagonally right below that the picture shows the upper half of the framing knob.

Take-Up and Rewinder

The take-up and rewind mechanism are shown in Figure 5. The take-up pulley, *Q*, is driven by a spiral spring belt which parallels the reel arm. This pulley, *Q*, imparts power to the reel pulley just below it by means of the short, flat, fabric belt, which is designed for correct slippage to assure proper take-up at all film lengths up to two thousand feet. In the illustration, the mechanism is in take-up position for normal projection.

Just right of pulley *Q*, between that pulley and the reel, there is a small lever. By pressing down on that lever, and at the same time lifting the reel hub, the reel hub and pulley assume a new position. In this new position the fabric belt is slack and inoperative, and the gear teeth of pulley *Q* mesh with the gear teeth of the reel hub. The projector is then ready for rewinding.

The film to be rewound is placed on the front reel arm; an empty reel is inserted in Figure 5; film is run directly from one reel to another, not through the projector, and the motor switch is turned on for normal operation. To avoid useless wear on the mechanism the clutch (just right of the lens in Figure 3) is disengaged by rotating the knob counter clockwise as far as possible.

The exciter lamp case, *Z* of Figure 2, is removed by loosening a thumb nut on the front of the case. When the lamp is removed from its bayonet-type socket it will be seen that there is a guide mark on the frame of the casing just behind the lamp, in line with the position the filament of the new lamp should occupy. If the filament of the new lamp is found not to be at the right height, as indicated by this guide line, there are two set screws on the socket that can be loosened to permit vertical positioning.

The drum just left of the exciter case, in Figure 2, is the sound drum, on which the soundtrack is scanned. A mirror, invisible in the picture, is located behind this drum and reflects the exciting light into the photocell.

Figure 6 shows the polarized terminals for either one or two speakers, and for amplifier power input from either a 115-volt a.c. line or from a suitable external device which is available for use where other power supplies are encountered. To the right of this is the amplifier fuse, a two-ampere glass type. It is removed by inserting a screwdriver or a coin in the slot of the fuse holder.

Maintenance Routines

Lubrication points are illustrated in Figure 3. Oil cup *A* is to receive one drop of projector oil for each four hours of sound operation; cups *B* and *C* one drop for each sixteen hours of sound operation. Oil these cups only half as often for silent operation. Felt reservoirs behind oil points *D* are to be saturated every three months for sound operation; every six months for silent projection. For that purpose, disconnect all cables and lay the projector on its side, mechanism up.

A grease cup on the top or forward projection arm, not visible in these illustrations, requires grease after approximately 100 hours of operation.

Refer again to Figure 1: where the film leaves the projector case on its way to the lower reel, apply one drop of oil for

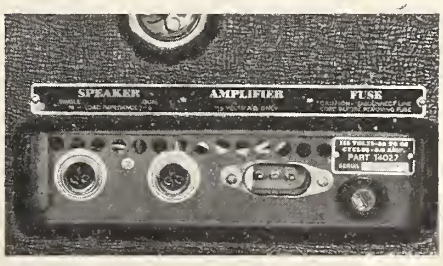


FIGURE 6



FIGURE 7

each 100 hours of operation to the idler rollers. Also, one drop of oil every hundred hours to the idler rollers where the film enters the projector case on its way down from the upper reel. In Figure 2, just left of the reversing switch there is an idler roller, and directly below the silent-sound switch a pair of snubbers. These also receive one drop of projector oil every hundred hours.

In cases of trouble, remember first of all that the external connections to power or loudspeakers may have been kicked free by the audience; remember that in this particular projector unsatisfactory sound quality may result from the silent-sound switch being set in "silent" position. The amplifier can be removed from the projector by removing four screws at the bottom of the projector case, then sliding the amplifier out while the projector is lying on its side. (See Figure 7.) The lead, *LW*, in that illustration, supplies current to the exciter lamp, and a defective connection here may be the cause of the exciter lamp failing to light.

UNDERWRITERS' LABEL GIVEN TO LAKEWOOD REWIND SWITCH

The Lakewood Automatic Rewind Switch, distributed exclusively by National Theatre Supply, has received the approval of the Underwriters' Laboratories, and now carries the familiar "UL" label. The switch, since it originally was made available to projectionists, has undergone a number of improvements which include a new sturdy cast aluminum housing and standard Cutler Hammer heavy-duty switch.

The Lakewood switch has become increasingly popular with projectionists, as it eliminates the disturbing noise of film slapping until the rewind is stopped, it is pointed out. The switch is sold on a ten-day free-trial money-back guarantee, and according to National Theatre Supply orders for it are being received in steadily increasing numbers.

MIDGET TOOL SETS AVAILABLE

O. B. Dematteis, president of the Universal Tool Company in Kansas City, recently reported that tiny midget tools designed to fit in handy, compact rolls and cases for essential and war workers are playing an increasing role in increased production and efficiency of the country's workers.

This company was a pioneer in the field of securing the tiny midget tools made by the leading tool manufacturers in the country and assembling them in compact sets which are offered to craftsmen in radio, electronic, and other industries.

Sound Reproduction Amplifiers †

By *R. H. CRICKS, F. R. P. S.*

ALTHOUGH amplifier circuit diagrams look very involved and may look quite different one from another, actually they contain practically identical circuits which may be classified under the following headings:

1. *Power supplies.*
2. *Pre-amplifier, if any.*
3. *Voltage amplifier.*
4. *Power amplifier.*
5. *Switching for changeover, and film-disc microphone.*
6. *Gain control and fader.*
7. *Frequency response adjustments.*
8. *Cross-over network.*
9. *Provisional testing.*

Under heading 1, we have to consider not only the power needed for sections 2, 3, and 4, but in addition a polarizing voltage for the photo-cell and the power for the exciter lamps. The last generally is the only low voltage supply needed. Occasionally low-voltage a.c. is employed, but more often a transformer, rectifier, and smoothing circuit are provided, frequently as an altogether separate unit. The tungar rectifier is very suitable for this purpose, since its characteristics lend themselves to the supply of high current and low voltage.

Amplifier Construction

The supply for the rest of the amplifier usually is of quite orthodox type. Often, as shown in Figure 1, a single transformer is used with multiple windings. The first secondary is the high tension or voltage for the rectifier anodes—this is centre-tapped for h. t.

The second winding heats the rectifier filament and is centre-tapped for h. t. + (high voltage plus); this will also supply the voltages for the photo-cells. The other two windings l. t. (low tension or voltage) supplies, perhaps to the voltage and power stages, the valves in which are invariably of the indirectly heated type.

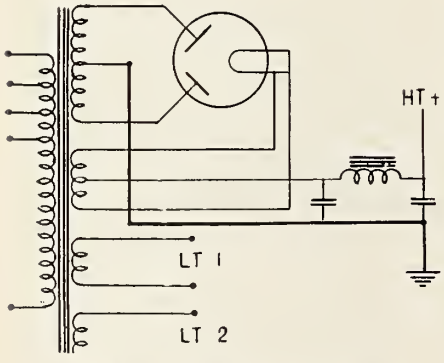


FIGURE 1. *Main supply unit.*

† *Ideal Kinema*, May 10, 1945.

The h. t. will have to be smoothed and then will have to be dropped in voltage to suit the requirements of the various valves. A distinction should be made between an ordinary dropping resistance in series with the load, generally used for the valve anodes, and the potentiometer circuit in which the resistance is in parallel with the load. The latter is used for valve screens and photo-cell voltages which need an insignificant current.

As shown in Figure 2, the voltage dropping resistance to the anode will be connected to earth through a condenser for de-coupling purposes. Notice also the bias resistance which connects the cathode to earth; since this resistance forms the earth return to the anode current a voltage drop is produced across it which is equal to the bias required on the grid.

Component Values

The designer will have to think not only of the basic circuits, but of the values of the various components. For instance, it will be no good making the output of the high voltage transformer winding equal to the voltage required by power valves, for there will be certain voltage losses in the rectifier and in the smoothing circuits.

Probably, too, the high voltage current will be fed through the primary of the output transformer, resulting in a further voltage drop. These losses, as well as the values of dropping resistances required by each of the earlier valves, can be computed by means of Ohm's Law.

Pre-Stage Amplification

Turning now to the second circuits, the pre-amplifier customarily used to be built into the soundhead. Now, however, there is a tendency to build it into the fader unit, which is mounted on the front wall of the projection room—close enough to the projectors to cause the minimum losses through the connecting cable, but well away from the vibration of the projector.

The pre-stage amplifier generally will be a single high-gain stage with multiple electrode valve, which facilitates the same handling of the minute currents involved.

The voltage amplifier is conveniently considered apart from the pre-stage. It will consist of two or three valves generally of medium gain type. Resistance

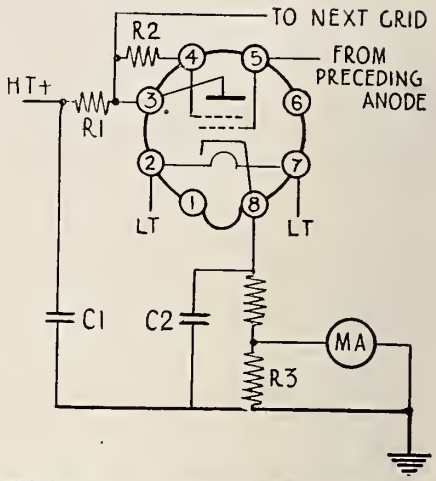


FIGURE 2. *Typical valve circuit. R_1 and R_2 voltage dropping resistances. R_3 biasing resistance. C_1 de-coupling condenser. C_2 condenser to prevent oscillation.*

capacity coupling is usually preferred to transformer for these stages

Push-Pull Design

The output stage of modern amplifiers consists invariably of a pair of power valves in push-pull (or in one or two cases two pairs of such valves.) The most straightforward way of connecting the push-pull stage is by means of a centre-tapped transformer, but a circuit which is increasing in popularity is the phase inverter. There are many variations of this circuit, but fundamentally the principle is that the signal is fed across a resistance from the opposite ends of which two driver valves are fed, each driving one of the push-pull valves, consequently in opposite phase.

In any push-pull circuit it is desirable that provision should be made to compensate for the mis-match of the two valves. Often, therefore, a two-way potentiometer or an ordinary variable resistance is interposed in the mid-point of the push-pull circuit by adjusting which the load on the valves may be matched.

A feature found in many amplifiers is negative feed-back. The object of this is to reduce distortion due to non-linearity of the valve characteristic. It therefore permits of a valve being worked through a wider range of its characteristic and thus increases the effective undistorted output of an amplifier.

The principle is simply that part of the output of one stage is fed back to the input of a preceding stage, in opposite phase to the signal on that stage. Thus any *even* harmonics come back from the later stage at greater power than in the

There's a "G.I." projectionist right behind them...



OFFICIAL U. S. COAST GUARD PHOTO

BEHIND the tanks and booming guns, the amph-tracks and the jeeps, you'll find G. I. movie-projection men . . . setting up shop to bring the boys a few bright hours on "Main Street". . .

"Movies tonight!" Ask any morale officer or—more to the point—ask any Yank what that means. You'll learn how really important movies are when men are lonely and tired and a long way from home . . .

And it all adds up to this: The job being done by G. I. projectionists—movie-trained—is just about as big a contribution to military morale as can be imagined. The best evidence is written on the boys' faces . . . when they hear that call of "Movies tonight!"

One of a series of advertisements by KODAK testifying to the achievements of the movies at war



Eastman Kodak Company, Rochester 4, N. Y.

J. E. BRULATOUR, INC., *Distributors,* Fort Lee, Chicago, Hollywood

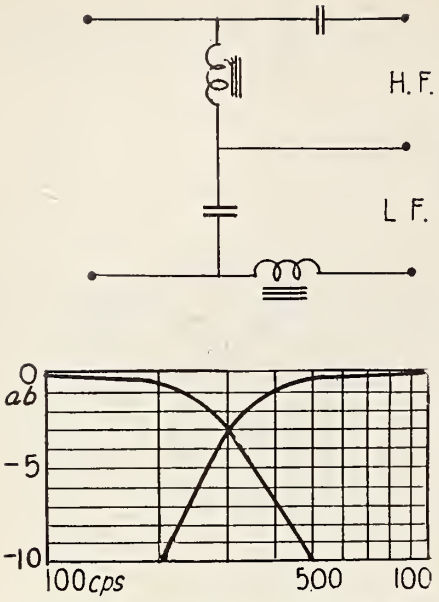


FIGURE 3. ***Cross-over network and frequency characteristics.***

original signal, so that distortion of this nature in the intervening stages is cancelled out.

Another reason for the reduction in size of amplifiers which any projectionist of a few years' experience will have noticed is the use of multi-electrode valves, which for a given dissipation will give a greater undistorted output. The usual type of base for such valves is the octal. While the internal connections have not yet been standardized, circuit drawings can easily be followed if it is remembered that the numbers of the pins always run from the locating key.

Changeover Switching

Next we come to the two sets of changeover switching required. First, from one projector to the other, and second from film to non-sync. or microphone. The first naturally follows after the pre-stage valve, the output from the changeover switch feeding into the film-disc-mike switch. Sometimes, of course, a two-way fader is used in place of the switch. It generally is preferred to have the gain control and fader a stage later in the voltage amplifier.

There are in the modern amplifier three distinct frequency-selective circuits. First is the equalizer, usually associated with the film-disc-mike switch. This serves the purpose of equalizing the frequency characteristics of the three input channels.

Next, the output has to be suited in quality to the acoustics of the auditorium. For this a pre-set filter system is provided. The circuit of this is usually based on the fact that an inductance will pass lower frequencies freely while attenuating the upper frequencies, and a condenser has the reverse characteristics. In some circuits the proportion of speech current taken through an inductance and a condenser is varied. British Acoustic has always favored a circuit embodying one set of condensers in series and a second in shunt.

Whichever type of circuit is employed it is not generally intended to be adjusted by the projectionist. Frequently the response is set by means of soldered connections. In other cases adjusting screws are provided, or sometimes concealed knobs.

Cross-Over Network

The third selective network is a cross-over network for the treble and bass speakers. The principle of this circuit is shown in Figure 3, from which the method used for obtaining the different response curves of the speakers will be clear. The cross-over point as shown in the lower part of this diagram is generally fixed at 300 c.p.s. (cycles per second), at which point both curves should show a drop of 3 db.—that is, at the cross-over point the output of the two speakers together is equal to the maximum from either set.

Circuit Testing

The final detail required in the amplifier is some provision for testing the various circuits. Early systems employed a milliameter in each stage, but the method more usually adopted in modern amplifiers is a single milliameter with selective switch so that readings can be taken in any circuit merely by moving the switch

As shown in Figure 2, the point usually selected for measuring valve emission is the connection between the cathode and earth, generally the voltage dropped across bias resistance. The former practice of providing meters for the high voltage and low voltage supplies is now superseded, since a drop in the low voltage is most unlikely, while any trouble with the high voltage will be indicated by a change in emission of all valves. In some equipment provision is also made for testing the individual loud speakers.

While a metering system will often localize trouble, it cannot always supplant the testing of internal circuits by the service engineer. A safety precaution often adopted is for the condensers to be shunted to earth through a high-valve leak resistance. This enables the charge to leak away when the set is switched off and thereby makes for safety in testing.

Overtime Records an Aid to Projectionists

A PERMANENT record book, showing how many hours of overtime were needed for a given repair job in the past, provides automatic indication of how many hours that particular type of work should require in that projection room if another similar breakdown occurred, and practically eliminates chances for differences of opinion.

Of course, the record must be reasonably detailed. It is possible that the same job will need more time on another occasion. If so, there will be a reason for that and if the record includes a moderate degree of detail the facts will be clear and difference of opinion will be avoided. Thus the record should include not only the nature of the work done, but also any exceptional difficulties encountered in completing it.

The record also will serve as a guide to the projectionist in planning an overtime job, giving him a reasonable indication in advance of approximately how long it is likely to take. It should be indexed simply, otherwise it may be necessary to wade through the book page by page looking for the recording of a specific job.

All that is needed for a permanent record is a ledger or a large notebook. Write the date at the top of the page, and under that date state the nature of the work done and any unusual difficulties encountered. Note the number of hours it took to complete the job and the number of men working on it. On the last or index page of the book, just write the type of work done and the date; for example, "Changed projector head." June 16. For detailed information about that particular job you just turn to the page dated June 16.

The record will prove a useful guide when apparatus replacements are considered; indicating at once which items of the equipment have given the most trouble and therefore ought to be among the first replaced. A record of this kind very likely will run back before the time the projectionist was employed in that particular projection room and will, therefore, give him a better background as to the weak points of a given installation. It will perform the same service for a new projectionist, taking over for the first time and prove similarly helpful to a new service inspector.

To make the listings more complete, a record should be kept of any work done during breakdowns. Suppose, that is, that a very poor amplifier needed repairs six times during the course of a year—four times after the show (as a precautionary measure to prevent possible trouble), and twice during the show because of breakdowns. If only the overtime were recorded, the book would show that the amplifier needed serious attention only four times in one year, and thus be misleading with respect to the reliability of that apparatus. Emergency work during the show should be entered and indexed in the same way as overtime work.

Motion Picture Projection in the Soviet Union

By *AARON NADELL*

Russian projection equipment, so far as permission could be gained to observe it, appears to be well designed, built and operated, and does a fairly good job. Some details of it are unusual and interesting; particularly the use of enormously heavy pedestals, and lamphouse condensers more than 13 in. in diameter.

THEATRE MANAGERS in the Soviet Union are not authorized to admit strangers to their projection rooms. Permission for such visits must come from high government authority—very high authority, and separate permission is needed for each theatre. In consequence of these formalities only one projection room could be visited, and the Russian equipment described below must be understood to represent only one model.

The writer was told it was manufactured in 1928, and intended for a small village theatre. Its use at present in the major city of Odessa is said to be the result of looting by the enemy, who carried away the regular installation. It is also said that newer and superior apparatus exists, but that the best of it is reserved for the use by the Russian army.

Projection Room Layout

The projection suite visited consists of four rooms—generator room, tool room, rewind room and projection room proper. Some of the present arrangements are plainly of make-shift nature; how far they represent the original conditions of the theatre could not be clearly ascertained. The suite was reached by a kind of metal fire-escape which rose from the back yard. The original stairs had been bombed away.

The projection room itself is fairly large, possibly forty by twenty-five feet. Architectural considerations made it desirable to group the two projectors at one end of the front walls. This location gives substantially a straight throw, with a projection angle of approximately zero. Distance to the screen may be sixty or seventy feet.

At the opposite end of the projection room, flanking what is at present (perhaps was always) the only entrance, are two large switchboards of the old-fashioned marble type, standing about eight or nine feet high, and equipped with voltmeters and ammeters having white-face scales about a foot in diameter. One of these boards is for a.c., the other for d.c. Fuses must have been enclosed somehow, at least none were visible. Switches of the knife type were mounted on the face of the marble. The interpreter's limited grasp of English made questioning difficult.

Mounted on the front wall, perhaps six feet from the nearest projector, are four amplifiers. Each is placed separately on its own shelf or bracket. They are neither side by side nor one above the other, but staggered in a zigzag arrangement apparently intended to provide maximum accessibility in a limited space, although in this theatre the wall space available is ample.

Coaxial cable about ¾" thick, mostly buried in the front wall, connects these amplifiers to the projectors. The fact that other apparatus once had been installed in this place was confirmed by an unused cable of the same type which emerges from the front wall at another point, terminating in nothing.

The Projectors

The projectors are mounted on the most massive pedestals this writer has ever seen. They are of the one-legged, unbraced type, but the single, rectangular vertical support is so large as to be almost of the same dimensions as some of the smaller enclosed-type pedestals used at home. the lamphouse is set on an enormously thick and heavy bedplate, which can be tilted by means of a single large worm. There is about a foot of distance between lamphouse and projector, where this heavy bedplate forms a broad and massive shelf. The driving motor, which might be ¼ horsepower by its size, is mounted directly on this shelf, at the left or drive side. Its shaft extends straight into the rear of the projector mechanism.

Whoever designed that pedestal was determined to throw in so much mass that all the drive motor's power would never be enough to make vibration possible—on the general principal that a Pyramid can't be shaken by a flyswatter.

The projector mechanism and soundhead appear to be a single assembly. The driving side is enclosed, the film side open, and the film runs in the open; but some details, such as photocell, lens assembly and exciting lamp, though located on the film side, are under separate caps of their own which the writer could not persuade the projectionists to remove.

The exciting lamp beam is horizontal, the lamp being located toward the rear of the projector and the photocell toward the front. The intermittent action is based on the Maltese cross. The projectionists recognized a rough sketch of it, and one of them knew the word Maltese.

Film motion is steadied by means of a drum about 2 inches in diameter, and there is a steady-running sprocket between the sound pickup and the lower magazine. Other driving and control details, framing details, etc., could not be learned, many parts being enclosed and the interpreter having a very limited command of technical English.

The Lamphouse

The lamphouse is small, rectangular, and rather resembles in appearance an old, American vertical-type low intensity lamp. It is vented directly to the projection room. It has no ammeter—in fact there are no meters on any apparatus; the large, white-faced instruments on the two switchboards serving all purposes.

The lamphouse uses both mirror and condenser. The latter is of enormous diameter—13.7 inches. 350 millimeters. The mirror is roughly the same size. Mirror surface is continuous, no carbon feeds through it.

The carbons are located between mirror and condenser, close to the mirror, and arranged practically at right angles to each other. The image of the crater is picked up by the mirror and reflected to the condenser. Feed is automatic, but neither carbon could be seen to revolve. Both carbons are the same size, copper-coated and roughly half an inch in diameter. They have an extremely thin core, something like that of an old-style American "solid" carbon. What appears to be a magnet curves upward and quarter way round the lamphouse, at the location of the gap. There is a small, asbestos flame shield.

Neither mirror nor carbon showed the slightest trace of pitting, and the burning area, as observed, apparently did not sputter at all. Operation was at 90 volts, 20 amperes, but it was explained that 45 amperes are used when normal electrical supply is available. (Odessa's generat-

ing plants were destroyed, and have not yet been fully repaired; the nearby coal mines have been flooded and are not yet restored to operation.)

The size of the motor-generator, a 10 kw machine, bears out the statement that larger current values are used under normal conditions.

This motor-generator is located (temporarily perhaps) in a room so small it has two doors—one for access to the motor and one opening on the generator end. The machine is of horizontal construction, possibly six or seven feet long. The commutator was in marvelous condition; not a trace or ghost of sparking was visible. It is a wide commutator, each set of brushes consisting of three-in-line; and of course it was running at half power when observed.

The Film

As much of the film as the writer was able to examine in the rewind room was in perfect shape. No splice was found, nor any trace of damage at a sprocket hole, and no oil stains or scratches were seen. There was no evidence of any kind of protective coating.

The sound track was of the variable area, noise reduction type.

The projection reels are very like American shipping reels, though possibly of somewhat heavier gauge metal. A reel of film as projected is roughly 1,000 feet long, judging by appearances, but of course the metric system is followed here; possibly the length might be 400 meters. Such attempts at timing as could be made seem to indicate that reel length varies considerably.

No changeover devices were observed. Visual changeover seems to be effected by the two projectionists working dowsers in unison. They were not observed to switch sound, and perhaps no switching is necessary.

Sound Equipment

The external appearance of the four amplifiers will be clear at once to anyone who remembers the old Samson P. A. amplifiers—a metal box of a chassis with sloping sides and rounded corners, having exposed tubes and shielded transformers mounted on top. There are four or them, painted green instead of gilt like the Samson—two voltage and two power amplifiers. One set is the emergency channel—"resting" was the way the interpreter explained it. The monitor speaker is a common type electro-magnetic six-inch cone. It was unenclosed, unmounted, simply standing on one of the amplifiers. Connection to it was made by untaped, unsoldered, twisted splices, the only sample of sloppy workmanship, or careless construction or assembly, seen anywhere

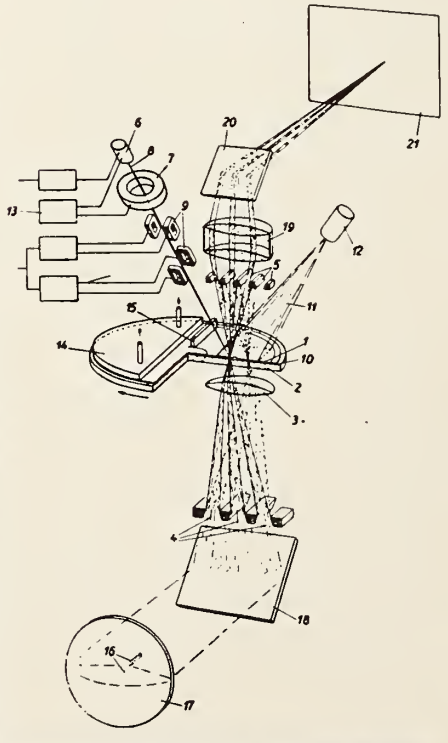
(*Continued on page* 28)

Swiss Television System Combines Electron Beam and Arc Lamp

NOVEL and ingenious methods of producing large-screen television have been reported from Switzerland—consisting essentially of a combination of the principles of arc lamp and cathode ray tube.

Whereas the most widely discussed method of securing theatre size television images is based on the principle of producing the picture in a cathode ray tube (as with home television) and then enlarging it by optical means, and other methods call for high power light sources with such mechanical scanning devices as rotating mirrors, this Swiss suggestion retains the flexibility of operation of the cathode ray tube but unites it with the intensity of light that can be obtained from a projection arc. Information as to the quality of results obtained is not at present available.

Figure 1, reproduced from *Electronic Engineering*, a British publication, illustrates the essential principles of the process. The arc lamp and its reflector are indicated at bottom, left, as items 16 and 17. The light beam is reflected from the inclined mirror (18), upward through the spaces between the lower bars (4), further upward through the lens system (3) and through the circular plate to the upper bars (5). The optical arrangements are such that normally bars (5) completely stop all the light that emerges through the spaces between the lower bars (4); the screen (21) then remains dark.



Schematic diagram of the large screen projector.

But the circular plate (2) carries an extremely thin film of semi-conducting transparent liquid, through which the light beam passes. There are two electron guns, similar to the electron gun of a cathode ray tube. One (12), at its right-hand side of the drawing, floods a substantial surface of the liquid with an even bombardment of electrons.

The second, including items 6, 7, 8, and 9, comprises an electron gun scanning beam (8 is the beam of electrons). Beam 8, just as in a cathode ray tube, scans a predetermined area of the liquid surface point by point, as if that liquid were the fluorescent screen of a cathode ray tube. The liquid is depressed, or dimpled, where the beam (8) touches it, in proportion to the intensity of the beam at that instant. Hence light passing through that point of the liquid surface is deflected, is not stopped by the upper bars (5), and appears on the screen (21) as one point of light.

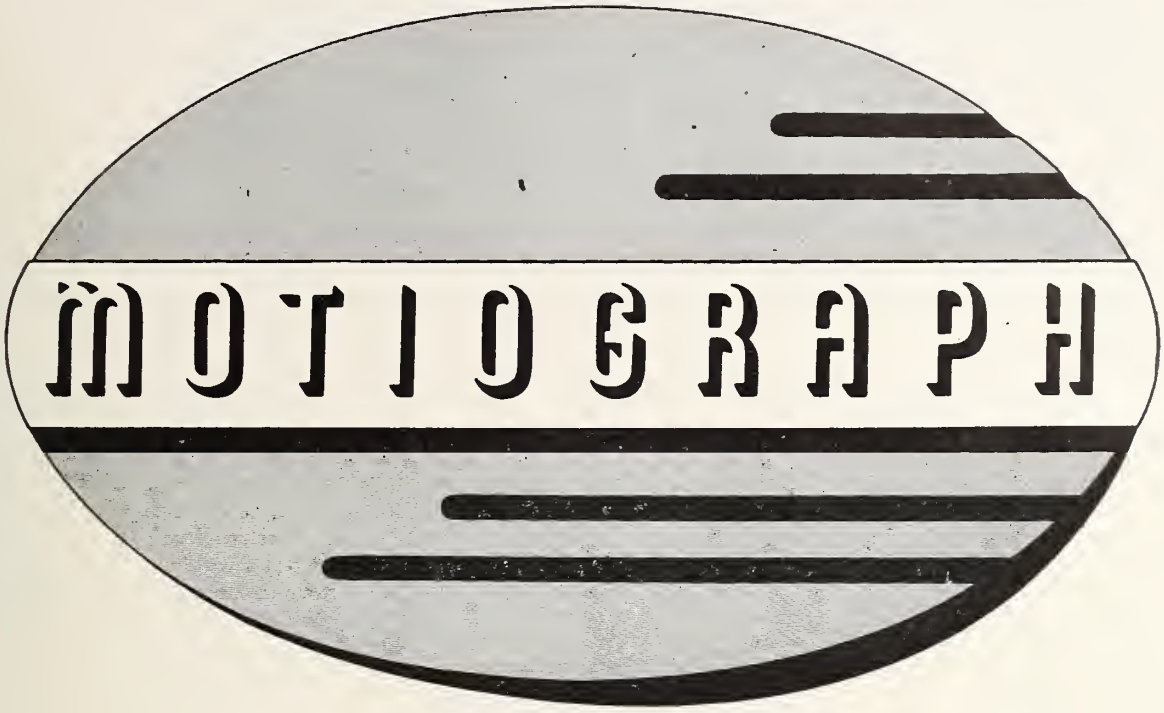
The glass plate carrying the liquid film revolves slowly and continuously, so that the heat generated by the passage of the light beam can be removed by the cooling plates (14), and the dimples flattened out by a squeegee (15). This revolving, liquid-carrying plate and the two electron guns must, of course, be inside a high vacuum, which is maintained by vacuum pumps that are part of the apparatus assembly.

ARMY PIGEONS EFFICIENT IN CARRYING FILM

Undeveloped film can be transported swiftly and reliably via pigeons and they may be used as a means of returning film negatives without the use of messenger personnel, according to a report of an Army signal photographic company which has conducted a series of experiments in collaboration with the Fort Sam Houston pigeon lofts. It is pointed out that although only a third of one per cent of Signal Corps men are engaged in developing communications by means of pigeons, the success of these recent tests is proof that pigeons are not considered obsolete in the complex pattern of modern military communications.

One example of the experiments showed that birds of an average size and strength can carry three 4 x 5 packfilm negatives or 20 frames of 35-mm film a distance of 30 miles in the average time of 45 minutes. They can safely be released from planes traveling at a speed of 200 miles an hour up to altitudes of 31,000 feet.

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IN THE SPOTLIGHT



By *HARRY SHERMAN*

CHAIRMAN J. A. KRUG of the War Production Board urges all unions and management to work out vacation schedules on a stagger system throughout the year. "All work and no play for 52 weeks a year is bad for production," declares Krug. And bad for one's morale, Chairman Krug might have added.

Incidentally, I. A. President Walsh in his report to the delegates at the 1944 convention endorsed the principles of vacations with pay. "I want it clearly understood," reported Walsh, "that not only do I favor the principle, but I recommend that the local unions make an effort, through negotiations with employers, to have a clause incorporated in their contracts providing for vacations with pay for their members."

● For the past several months the officers of Local No. 386, Columbus, Ohio, and the independent exhibitors of that city have been wrangling over the terms of a proposed new contract. The union officials have asked for time and a half for Sundays, half-hour overtime pay on change days, and a standard 6:30 P. M. to 12 midnight schedule, with overtime beyond those hours. Robert W. Greer, president of the union, charged that the exhibitors refused to discuss the terms despite the fact that negotiations have been going on since the beginning of the year.

As we predicted, the issue of extra pay for working Sundays and holidays will be bitterly contested by the theatres—even though it is an accepted fact in every other industry in the country. Several IA locals have already won that point and we believe that eventually all contracts will call for Sunday overtime pay.

● Hy Goldin, district service manager for the Dominion Sound Equipment, Ltd., Toronto, called at the offices of IP on his recent visit to New York. Hy has specialized on sound systems for theatres for a number of years and has written many articles on the subject.

● We congratulate George E. Raywood, business agent of Local No. 316, Miami, Fla., upon the elevation of his son, George Henry, to the Holy Priesthood of the Society of Jesus. The Ordination takes place on June 17 in the Chapel of the Immaculate St. Mary's, Kansas, and Father George Henry Raywood will hold his First Solemn Mass the following Sunday at the Gesu Church in Miami.

● When in Chicago last month, we ran into Charlie Vencill, Los Angeles Local No. 150 secretary. Charlie was attending the National Conference of Union Labor Legionnaires Convention, of which he is president.

● **IA Pres. Walsh has announced the retirement of former Secretary-Treasurer Louis Krouse, who has been in failing health for quite some time. At a special IA executive board meeting held in Los Angeles last month, it was unanimously voted to retire Krouse on half pay for the rest of his lifetime.**

Assistant Pres. William P. (Fred) Raoul, of Projectionist Local No. 225, Atlanta, Ga., was elected to fill the vacancy. At the time we went to press no announcement had been made regarding the appointment of a new assistant president, and it is understood that Raoul will fill both of these posts for the present.



Wm. P. (Fred) Raoul

● A $64 question—What is being done with the copper dripping savings that the projectionists throughout the country have repeatedly been urged to save and turn over to the salvage committees? Many of these men have religiously saved all copper drippings and in trying to dispose of it discovered that the so-called salvage committees were not interested.

A letter received from one of our readers, the secretary of a fairly large midwestern local, tells of his experience in that direction. He writes, "I notice in your columns that you still advocate the saving of carbon drippings. I would like to tell you of our experience here in attempting to salvage copper.

"All the boys saved their copper drippings and strippings and turned it in to the local supply house, which, in turn, sold the copper to a junk dealer. The proceeds from the sale of the drippings were turned over to the Red Cross. The junk dealer found himself unable to dispose of the salvaged copper, could not find anybody to take it off his hands, and he demanded that the supply house refund his money. Upon being told that it had been turned over to the Red Cross and could not be returned to him, he brought suit against the supply house and the matter is now pending in court.

"At the present time we have in our projection room about 50 pounds of copper drippings, and nobody knows what to do with it."

This is but one of the many letters we have received asking us what to do with copper drippings. We were under the impression that most communities had salvage committees to take care of such matters. Perhaps some of our readers could enlighten us a bit on the subject.

● "Because of the importance of the SOUND MOTION PICTURE PROJECTIONIST, he must be a highly trained expert. And because of his importance and his skill in handling high-priced equipment he receives high wages—up to as much as $250 per week."

The foregoing is an excerpt from a circular that reached our desk the other day, and which is part of the sales promotion campaign of a certain west coast projec-

tion school soliciting students for its courses. While we agree with the statement concerning the importance of the projectionist's skill, we cannot let the statement relative to the "high wages" go unchallenged. We do not know of any projectionist in this country receiving a salary of $250 per week, and we doubt very much if this particular school does either. We consider this brand of advertising misleading, to say the least, and we suggest in the best interests of all concerned that the exaggerated statements appearing in the circular be modified.

● Hats off to C. W. (Pat) Offer, business agent of Local No. 165, Hollywood, for his grim determination to gain better working conditions and more pay for his members. His untiring efforts were rewarded last month when the War Labor Board approved the new contracts which provide for the following benefits:



C. W. Offer

1. All non-working chief projectionists to receive a $10 per week increase.

2. Working gang boss projectionists will receive an increase of 16c per hour.

3. Weekly process projectionists to receive an increase of 15c per hour.

4. Although the regular projectionists and daily process men were granted a 5% increase in the negotiations with the producers (2% above that permitted under the Little Steel Formula), the WLB approved only a 3.4% increase for these classifications. All increases, however, are retroactive to January 1, 1944.

5. Approval of the Seniority ruling by the WLB. Local 165 now has full voice as to the hiring and firing of all members.

6. All time worked between 10 P. M. and 6 A. M. pays a 10% premium over the rate of pay prevailing during these hours.

7. All time worked in excess of 6 hours, without a meal period, pay 2½ times the regular prevailing daily rate.

8. One hour's pay or work is guaranteed after each meal period.

9. All time worked in excess of 14 hours after reporting to work, mealtime included, to be paid at 2½ times the regular prevailing daily rate.

10. When a projectionist is required to perform work in a higher classification for more than one hour during a shift, the entire day will be paid for at the higher classification.

11. Calls may be cancelled or changed if made before 8:30 p.m. of the day preceding the call, or with 6 hours' notice prior to the time of the call, on the day of the call, providing such notice is given after 7 a.m. on the day of the call. (This eliminates the practice of calling up our men at all hours of the night.)

12. The placing of complete supervision of the projection department personnel and equipment in the hands of the chief projectionist, who must be a member of Local 165.

13. All projection equipment leased by the producers must be manned by a member of Local 165.

14. Two weeks' severance pay in lieu of two weeks' notice of termination of employment.

15. Two weeks' paid vacations for all regularly employed projectionists each year, and one day's vacation pay for each 20 days worked for our casual (swingmen) workers each year.

According to the approved terms outlined above, the total increases to the membership of Local 165 (217 active members) amounts to approximately $72.000 per year. To this, all we can say is "Swell job—well done."

● Definite word has been received by the Raaflaubs, Syracuse Local No. 376, that their only son, Bob, died in action in the Pacific area, February 16 last. For a time he was reported missing and it was hoped that the boy eventually would turn up safe and sound. Our deepest sympathy is extended to the sorrowing parents.

● **Chicago Local 110 Highlights:** Governor Green, of Illinois, recently appointed Gene Atkinson, business manager of Local 110, to the Selective Service System Appeal Board, representing labor. This is an indication of the wonderful comeback the local has staged during the past few years under Gene's management.

Contracts have been signed with the major theatre supply companies in Chicago calling for the employment of Local 110 men in the installation of any motion picture and television equipment within a radius of 150 miles.

The Drive-In Theatre in Chicago, which opened May first, renewed its contract with the local. The contract provides for two men per shift at $3.25¼ per hour, or $113.85 for 35 hours, for each man. In addition to this, each man receives one hour extra pay daily for servicing the speakers, this hour to immediately precede the "prep" time, which is also extra time. Each projectionist is to receive one week's vacation with pay each season.

The WLB approved the local's request for road-show scales of $3.57 per hour on the showings of all pictures where the top admission price, including Federal Tax, exceeds $1.00.

The members of Local 110 have been urged to double their efforts in the 7th War Loan Drive, in order to beat their own records in previous war loan drives. Their present goal is $300,000, and judging by their purchases of war bonds to date, about $190,000, they will achieve it.

● Thad Barrows, president of Local No. 182 Boston, has been appointed chairman of the Labor Division of the 7th War Loan drive. We expect to hear that the Boston labor organizations, under Thad's chairmanship, will be counted among the top bond buyers in the country.

● We recently learned that Charlie Brunner of Local No. 130, Altoona, Penna., and popular 4th District secretary, suffered the amputation of a leg. At last reports, Brunner's condition was serious but we trust he will soon be well on the road to recovery.

● Although the Iowa Fire Regulations bill was defeated when it was presented to the Iowa Legislature, the union officials in that state have not given up hope of obtaining favorable legislation in the near future on fire law regulations for theatres. According to a letter received from one of the union officials, who has fought the lax fire laws of that state for many years, it will take a terrible catastrophe, something like the Cocoanut Grove fire in Boston several years ago, to make the Iowa lawmakers aware of the need for more stringent theatre fire laws.

In his letter he writes, "Our bill was very simple and should have passed very easily if our lawmakers were at all interested in providing a little protection to

(*Continued on page* 27)



Members of Local No. 253, Rochester, N. Y., who are attending a television class conducted by Gerard Hall, Altec service engineer. Standing front, center, holding folded paper in his hand, is Allen Tindall, president of Local 253.

Instructor Hall, who recently conducted a course in Radio and Electronics for Signal Corps Reservists, may be seen standing at the extreme right in the front row.

Projectionists' Course on Basic Radio and Television

By *M. BERINSKY, E. E.*
MEMBER OF INSTITUTE OF RADIO ENGINEERS

XII--ALTERNATING CURRENTS (continued)

ALTERNATING currents do not behave like direct currents. In the early days of electricity we hesitated to use alternating currents because we did not thoroughly understand their behavior. This lack of understanding was due to the fact that alternating currents varied in amplitude as a function of time. Figure 2B in last month's installment (shown here as Figure A) illustrates this point. The voltage is seen to start at zero, rise to a positive maximum, return to zero, go to a negative maximum, and once more return to zero. Hence it was difficult to decide which value of voltage was actually being generated. It was decided to base the value of voltage on its ability to produce heat in a heating element as compared to a direct current voltage which produced heat at the same rate.

The value of alternating current voltage was decided upon in the following manner. Some scientists connected a heating element to a direct current voltage of 100 volts, and the element was immersed in a vessel containing a certain amount of water. After a given length of time had elapsed, the element was removed from the water and the rise in temperature of the water was measured with a sensitive thermometer.

A similar element was then immersed in a like quantity of water and an alternating current was connected to its terminals. The voltage across the element was slowly increased until the temperature of the water rose to the same value as in the first experiment. The time needed for this temperature rise was the same in each case. The alternating voltage was then measured and was found to have a peak value of 141 volts. It was then concluded that a peak value of 141 volts a.c. was just as effective in producing heat in a resistor as a direct current voltage of 100 volts.

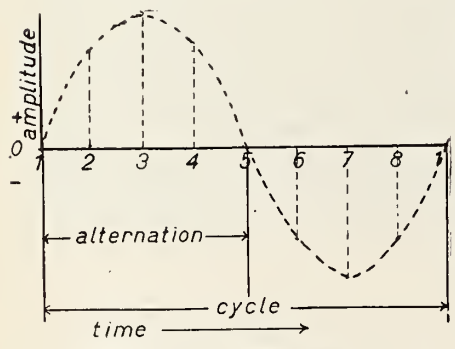


FIGURE A. *Sine wave.*

Average Values of a Sine Wave

Since a direct voltage of 100 volts is as effective in producing heat, and therefore, power, as a peak alternating current voltage of 141 volts, it may be assumed that 100 volts is the effective value of a sine wave voltage which has a peak value of 141 volts. The relation between peak and effective values of alternating voltages and currents was not really discovered in the manner outlined above. The fact remains, however, that this relationship could have been discovered in the manner just explained. The procedure was described because it is more easily understood when compared to a mathematical analysis. Some equations will not be given as to the relation between peak, average, and effective values of alternating currents.

Effective a.c. volts = Peak a.c. voltage × 0.707.

Peak a.c. voltage = Effective a.c. voltage × 1.414.

Whenever we speak of an alternating current or voltage and we do not specify peak or effective values, effective values are taken for granted. For example, when we speak of 110 volts alternating current, it should be understood that we mean 110 volts of effective alternating current. Let us try a few examples.

(1) Find the peak value of 110 volts a.c.

(Answer) Peak equals Effective times 1.414. The peak value of 110v. equals 110 × 1.414, which equals 155.7 volts. This means that the voltage in our homes has a peak value of approximately 156 volts.

(2) Find the effective value of 250 volts peak.

(Answer) Effective equals Peak times 0.707. The effective value of 250 volts equals 250 × 0.707, which equals 177 volts. It is hoped that the examples just cited will help to clarify the relationship between peak and effective alternating currents. Peak voltages are also known as maximum voltages.

Another important value of a sine wave alternating current is the average value. The average value of a sine wave taken over a complete cycle is zero. This is so because the voltage is as much negative as it is positive. Since these two values are equal and opposite, the average of the two will be zero. Alternating currents are not always considered over a complete cycle, however.

Sometimes a sine wave is considered over only one-half of a cycle. This is the case when pulsating direct currents are concerned. A pulsating direct current is really a form of a.c. Pulsating direct currents appear at the output of a radio power supply before filtering takes place. Measurements at this point usually are made with a direct current meter. The question as to what the direct current meter should read will now be clarified.

Direct current meters always read average values. If a direct current meter were placed across a source of alternating voltage, the meter would read zero. The average value of a sine wave voltage over one complete cycle is zero, therefore the direct current meter would read correctly. If the meter were connected across a source of pulsating direct current, the meter would not read zero but would read instead, some definite value. The voltage would not be zero because there is no negative half-cycle to average out the positive half-cycle. The average value of a sine wave over one-half cycle

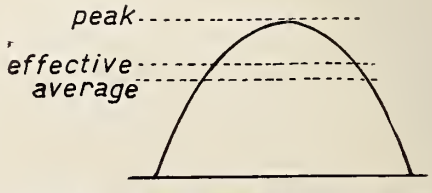


FIGURE 1. ***Maximum, effective, and average values of a sine wave.***

is equal to $2/\pi$ or 0.637 times the peak value.

(Example) A direct current meter is connected across a pulsating direct current voltage which has a maximum value of 200 volts. Find the value of voltage that will be indicated by the meter.

(Answer) The direct current meter will read the average value of 200 volts. Average voltage equals maximum voltage times 0.637. Average voltage equals 200 × 0.637 which equals 127.2 volts. This is the value which will be indicated by the direct current meter. Figure 1 shows the relative amplitudes of peak, effective, and average values.

Simple Trigonometry

The use of trigonometry is of extreme importance in alternating current work. Some simple trigonometric relationships will be introduced at this point. Trigonometry is a study of angles. There is a definite relationship between the sides of a triangle and the angles formed by these sides. For simplicity, the matter which now will be introduced will refer only to a right angle.

MAY QUESTIONS AND CORRECT ANSWERS

1. **(Q.) A 60 cycle, 8 pole, alternator is rotating at how many r.p.m.?**
   (A.) At 900 r.p.m.
2. **(Q.) How many poles are contained in a 25 cycle, 180 r.p.m. alternator?**
   (A.) Frequency in this problem should have been given as 60 cycles. The answer would then be 40 poles.
3. **(Q.) What is the frequency of an 8 pole, 900 r.p.m. alternator?**
   (A.) 60 cycles.

A right triangle is one which contains an angle of 90 degrees. Such triangles are very common in radio work. Let us refer to the triangle shown in Figure 2. The sides are identified by small letters and the angles by capital letters. This is the conventional manner for identifying the sides and angles of a right triangle.

Suppose that Angle A is the angle under consideration. It will be noticed that the sides of the triangle have been named *ordinate*, *abscissa*, and *distance*. Other names are sometimes given to these sides. Side (a) is sometimes called the opposite side because it is opposite to Angle A. Side (b) is sometimes called the adjacent side because it is adjacent to Angle A, and side (c) often is called the hypotenuse, which is the name given to the greatest side of a triangle.

It should be mentioned at this time that the sum of the interior angles of a triangle is equal to 180 degrees. This means that if one of the angles of a triangle is 90 degrees and the other angle is 50 degrees, the third angle must contain 40 degrees, thereby making a total of 180 degrees.

There are six common relationships between the sides of a triangle and the angles formed by them. These relationships are given in the form of ratios, which are called *sine*, *cosine*, *tangent*, *cotangent*, *secant*, and *cosecant*.

The sine (abbreviated *sin*) is equal to the ordinate divided by the distance.

The cosine (abbreviated *cos*) is equal to the abscissa divided by the distance.

The tangent (abbreviated *tan*) is equal to the ordinate divided by the abscissa.

The cotangent (abbreviated *cot*) is equal to the abscissa divided by the ordinate.

The secant (abbreviated *sec*) is equal to the distance divided by the abscissa.

The cosecant (abbreviated *csc*) is equal to the distance divided by the ordinate.

These relationships have numerical values which have been tabulated. The tabulations are known as trigonometry tables. The tabulations shown in Table A have been taken from a four place trigonometry table. The most common trigonometric functions are the sine, cosine, and tangent. Only these are shown. The functions shown in the table are for 0 degrees, 30 degrees, 45 degrees, 60 degrees, and 90 degrees. Space does not permit the printing of the entire tables here, but it should be remembered that values have been tabulated for all values between 0 and 90 degrees.

By transposing some of the equations above two very useful formulas are obtained. The $\sin A = \frac{a}{c}$. If this equation is transposed, we get $a = c \times \sin A$. With the aid of this formula we can find the value of side (a) if we are given the angle of A and the value of side (c).

Also, the $\cos A = \frac{b}{c}$. Transposing, we get, $b = c \cos A$. With this formula we can find the value of side (b) if we are given the angle A and the value of side (c).

Let us illustrate how these formulas are applied to a solution of the right triangle. Suppose that side (c) is 10 feet long and angle A is 60 degrees. The problem is to find the length of side (a). Side (a) is

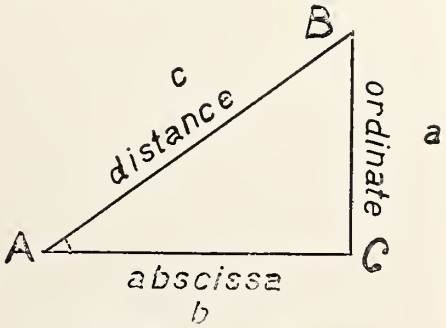


FIGURE 2. ***A right triangle.***

TABLE A

Angle (degrees)	*Sine*	*Cosine*	*Tangent*
0	0.0000	1.0000	0.0000
30	0.5000	0.8660	0.5774
45	0.7071	0.7071	1.0000
60	0.8660	0.5000	1.7321
90	1.0000	0.0000	Infinity

equal to side (c) times the sin of angle A. Substituting the values that are given, we have, $a = 10 \times \sin 60$ degrees. From the tables it can be seen that the sine of 60 degrees is equal to 0.8660. Substituting this value for sin 60 we get, $a = 10 \times 0.8660$, which yields 8.66 feet. Side (a) will, therefore, have a value of 8.66 feet.

We now will find the length of side (b) from the available data. Using the second formula, we have side (b) = 10 × cos 60 degrees. By referring to Table A we see that cos 60 degrees equals 0.5000. Substituting this value in the equation above we have side (b) = 10 × 0.5000, which gives 5.0 feet for the length of side (b).

JUNE QUESTIONS

1. **Find the effective value of a peak voltage of 1,000 volts.**
2. **Find the peak value of an effective value of 120 volts.**
3. **In a right triangle the angle A is 30 degrees and the side (c) is 100 volts. Find the voltage of side (a).**
4. **Find the voltage of side (b).**

The correct answers to these questions will appear in the next issue.

MORE DETAILS ON THE ALTEC RETIREMENT PLAN

H. M. Bessey, vice-president of Altec Service Corporation, in releasing additional details of the company's retirement pension plan for employes, stated that it is an independent trust with the Chase National Bank of New York City acting as trustee, and that the administration of the plan is under the control of an administrative committee upon which corporate ownership, management, district offices and personnel relations are represented.

In noting that Altec is granting past service credit to those who became associated with the company from Electrical Research Products, Inc., at the time Altec entered the sound service field, Mr. Bessey said that many of the Altec men thus have many years of service to their credit since they were pioneers in the installation of talking motion picture equipment. The average length of service is approximately 11 years.

Many Altec employes, he added, entered the armed services at the beginning of the war. These men are considered on leave of absence and full credit for the length of service while in the government's employ will be given each such individual upon his return to the company. All Altec employes, including those who have been added in recent years to replace those in military service, are covered under the plan. No contribution is required of any employe as Altec assumes the total cost.

AT YOUR SERVICE

This department is a collection of random thoughts and some not so random: fact, fancy and opinion relating to the man behind the man behind the gun—the serviceman. The prime purpose of this section is to promote a closer relationship between serviceman and projectionist based on a better understanding of their mutual problems through an exchange of news and views, kinks and kicks. To this end, contributions relative to any phase of the serviceman's activities are invited.

Correcting Intermittent Operation of 49-Type Amplifier

I find that an average of at least 90% of the D-95309 .1 mfd. coupling capacitors used in the 49-type amplifiers are seriously leaky. Removing a number of these on routine calls, a capacitor analyzer okays all on leakage tests, but no capacity measurement is possible, and an "open circuited" condition is indicated on such tests. None of the units removed will retain a charge over a few seconds, whereas a new capacitor of equal rating will deliver a substantial discharge spark after several minutes.

Those who have experienced trouble report a short sound outage on one machine which seems to correct itself after a few minutes of operation. I have replaced all such capacitors with tubular types where tests indicate a faulty condition. thus hoping to avert future emergencies which would otherwise seem certain to occur.—F. M. Walls, *RCA.*

Tracing Flicker in 83-Type Rectifier

A slight flicker at the plates of the 83-type rectifier tube in the MI-4256 power amplifier usually can be traced to a faulty and leaky by-pass capacitor in the MI-4236 voltage amplifier. If trouble occurs in the nature of a feed back, slight hum or motor boating, checking C-23, the 4 mfd. capacitor in the voltage amplifier, usually will reveal this as the source of trouble.—Nelson Spock, *RCA.*

Maintenance of Generator Brushes

Chattering of brushes sometimes is experienced on direct current machines. This trouble occurs with the type of brush holder which has a box guide for the carbon. Chattering usually takes place with high speed commutators running at 4,000 to 5,000 feet per minute peripheral speed, and a little lubrication on the commutator usually eliminates the chattering.

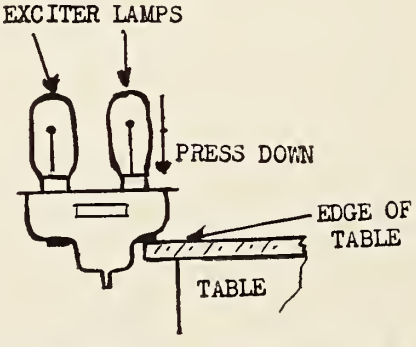
An open armature circuit may be due to a loose or broken connection where the armature lead is soldered to a commutator bar, or if the location of the open is within the winding and not readily available. For a temporary repair in such cases the commutator bars on each side of the open can be shunted by bridging a piece of copper or by soldering across the two segments on both sides of the break.

The sparking caused by this defect is unlike that caused by any other defect because the resulting spark generally is long and heavy. It is particularly destructive in its action and in a very short time eats away the mica between the two segments on each side of the open.

Another condition caused by armature defect is known as "ring fire," and may be subdivided into two classifications. The first is ordinary ring fire of a reddish color, and the second type of ring fire is a bluish green. Commutator ring fire ordinarily is due to minute arcs between the commutator bars. This condition may be aggravated by conducting materials lodged in or on the surface of the mica insulation between the bars. Carbon worn away from the brushes may cause this type of trouble.—M. P. Demming, *RCA.*

Removing Balky Pre-focused Exciter Lamps

An easy method of removing and replacing balky exciter lamps when they are hot is to remove the holder and press down on the edge of a table. as shown in the diagram. In this way the lens can



be removed with very little effort.—A. H. Knights, *RCA.*

Checking Soundhead Bronze Gears

Wear on bronze gears in the gear box of MI-1050 soundheads may be ascertained by rocking the motor back and forth to the points where there is no strain on the gears, and then move the constant speed and holdback sprockets forward and backward. If considerable play is present, it is indicative of wear and the gear box should be disassembled for repairs.—Nat Ripp, *RCA.*

Testing Emergency Amplifier

Occasionally when an emergency amplifier is set up during a sound outage it fails to function. The engineer may be undecided in such instances whether to test the new amplifier or the old associated circuits. In order to reduce this uncertainty, I use the following test. I carry one photocell with me which I insert into the photocell plug of the emergency amplifier and place it against the red pilot light on the emergency amplifier chassis. I have an a.c. voltmeter connected across the 15 ohm output. If the meter reads 4 volts, I know that the amplifier is not only operating properly but that its gain is normal.—Samuel S. Lebow, *RCA.*

Loosening Frozen Bearings and Screws

The freezing of soundhead or picture mechanisms sometimes occur wherein a rush is made for some form of penetrating oil, such as the so-called "Mystery Oil." If practicable, the locked or frozen parts are given time in which to cool off.

The freezing or binding of intermittents, shutter or optical gear trains, the baking in or rustiness of screws in apertures, shoes, tracks, etc., can readily be loosened and removed by obtaining from the nearest drug store a quantity of oil of wintergreen and applying it to the object. The oil of wintergreen will be found to be more effective than most patented oils.—Leo Cimikowski, *RCA.*

Checking the Output of PE Cells

In order to have some standard by which to judge the output of photo electric cells, I used the following method. Selecting a standard cell which I knew was satisfactory, I placed a distinguishing mark on the base and keep it for a standard of comparison. In order to check the output of other cells, it is only necessary to place this photo cell in a soundhead, adjust the exciter lamp and polarizing voltages to normal, connect the output meter to the amplifier and with the machine running, adjust the am-

(*Continued on page* 25)

Alert I. P. Readers Catch Error

THE article "How to Make Your Own Schematic and System Diagrams," by LeRoy Chadbourne, which appeared in the February 1945 issue of I. P., contained an erroneous statement of fact which was noted by a number of alert readers. Exception was taken to the author's statement on page 14, column 3, paragraph 2, in which he gives a rather misleading account of the action of the phase inverter tube VT-2 in the amplifier shown in Figure 3 on the same page. (The diagram is reproduced below.)

One of these readers, Roy L. Gallagher, of New Kensington, Penna., gives a correct analysis of the action of the phase inverter discussed and writes as follows:

"Contrary to Mr. Chadbourne's opinion, VT-2 *does* represent another stage of amplification, and with the proper tube and part values can provide a gain in voltage of ten to fifteen times the input from VT-1. This is in addition to its function as a phase inverter. His reasons for assuming VT-2 to be the phase inverter are logical and good, but he says the plate of VT-2 is coupled through a condenser to the grid of one of the tubes in the push-pull stage and "the grid of the other push-pull tube is supplied by VT-1. Assuming this to be true, let us consider what happens.

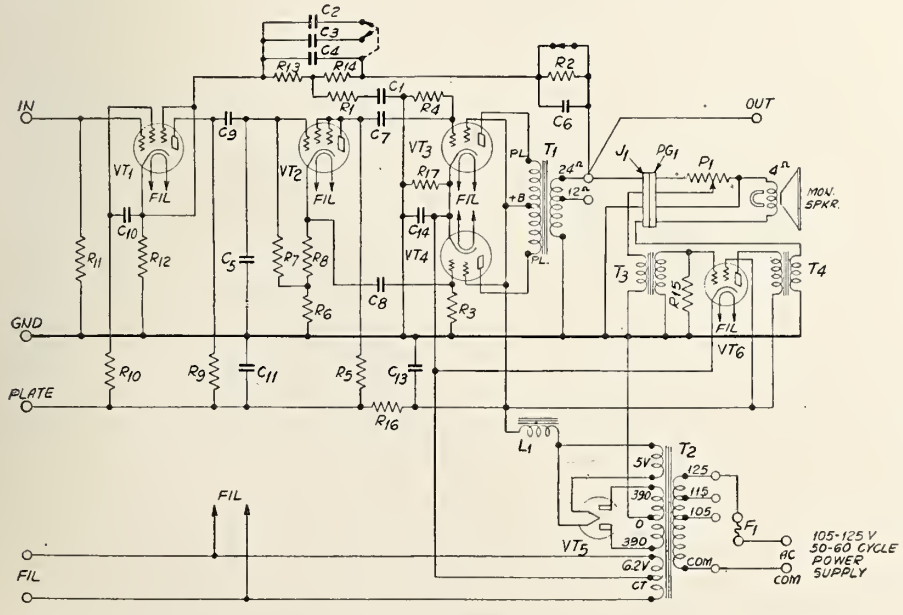
"Following the diagram, VT-3 is supplied with signal through C-7 from the plate of VT-2, which has amplified the voltage fed to it from VT-1 through C-9. At the same time the only way in which the grid VT-4 could be fed from VT-1, as Mr. Chadbourne says, would be through condensers C-8 and C-9, and resistors R-6, R-7, and R-8 These resistors would act as a voltage dividing network to cut the output from the plate of VT-1 to a value less than half of the voltage supplied to the *grid of VT-2*.

"Assuming the output of VT-1 to be 1 volt, and VT-2 to have a gain of 10—VT-3 grid would receive 10 volts, but the grid of VT-4 would receive from VT-1 one-half volt or less through the resistor network mentioned above. Not very good for a push-full stage, I think you'll admit.

"What really happens is this—Resistors R-5 and R-6 are made equal in value. When a signal is applied to the grid of VT-2, over the *positive* half-cycle the current in both resistors R-5 and R-6 *increases*. The increased flow of electrons from the *plate* of VT-2 must return to its cathode by way of resistor R-6. The increased voltage drop across R-5 makes the plate of VT-2 more *negative* (less positive) with respect to ground. But the increase in voltage drop in R-6 causes the cathode to become *more* positive with respect to ground.

"Since resistors R-5 and R-6 are made equal in value, the peak negative value at the plate is equal to the peak positive voltage resulting at the cathode. Because these two peaks are of opposite polarity at any instant, they are 180° out of phase, and can be used to feed the grids of VT-3 and VT-4. R-8 is used to supply the proper bias for VT-2 and should be bypassed with a large capacitor, unless degeneration is desired. Degeneration probably is not wanted in this stage, considering the rather elaborate feed-back circuit employed elsewhere in this amplifier.

"Actually, then, VT-4 is a 'cathode follower,' following variations across resistor R-6 in the cathode circuit of VT-2. These variations are 180° out of phase with the variations in plate resistor R-5, which are fed to the grid of VT-3. Thus, true push-pull action is obtained without a transformer; R-7 is simply the grid resistor for VT-2 and is returned to the negative or ground side of R-8 to secure bias voltage on the grid."



EASTMAN EXPLAINS ITS STAND ON VIDEO DEVELOPMENT

The Eastman Kodak Company, in discussing the status of television, states it is appropriate to say that the organization hopes to be ready to provide whatever photographic and optical supplies the television industry may require. "The present Kodak relationship to the television field is an exploratory one," it is said, "with the company in the stage of learning what film, apparatus, and lenses may be required.

"Contrary to recent published speculations on the subject, Kodak is doing no development work on television equipment nor has it any 'program' along that line . . . but this company, as the largest photographic manufacturer, is keeping its eyes open to see how its products may fit into the needs of the new industry."

RCA TO OFFER FULL LINE OF DRIVE-IN THEATRE EQUIPMENT

The Theatre Equipment Section of RCA Victor, anticipating a widespread development in drive-in theatre construction immediately after the lifting of wartime restrictions on building materials, equipment and gasoline, plans to supply a complete line of sound and projection equipment designed to meet special requirements of this type of theatre.

According to Barton Kreuzer, manager of the section, the line will include many special features developed by RCA engineers to resolve sound and projection problems peculiar to drive-in theatre operation.

The plans for this expanded activity in the drive-in field are revealed in a 32-page illustrated booklet entitled "The Drive-in Theatre," which is being distributed through RCA theatre equipment dealers. Also contained in the booklet is advice on the selection of a site for a drive-in theatre, discussion and diagrams of various types of construction covering the projection booth building, screen tower, ramps, and parking area, and advice and sketches on equipment installations and RCA technical services.

A three-page chart is shown of average temperatures for each month of the year in 64 widely scattered communities, representing virtually every State in the Union, to indicate the approximate length of the drive-in theatre operating season in various regions.

It is pointed out that many factors must be considered when selecting drive-in theatre equipment in order to insure sufficient illumination on the screen and sufficient power to operate the speakers at the required volume level without distortion. The equipment must provide an adequate source of light, high efficiency of light transmission to the screen, and rock-steady projection. Amplifiers must be considerably more powerful than those used in most of the enclosed theatres, especially where individual speakers are permanently installed on the field or where in-car speakers are used.

HAUSLER NAMED GEN'L MANAGER FOR CENTURY PROJECTOR

H. H. Hammons, president of the Century Projector Corporation, announced the retirement of Sam Kaplan as general manager. W. D. Hausler, who has been associated with Century since 1938, has been appointed vice-president and general manager. L. W. Dave continues as sales manager, and Geo. G. Steilin has been named factory manager. Mr. Steilin has had extensive engineering and manufacturing experience with motion picture projection equipment.

LETTERS TO THE EDITOR

To the Editor of I. P.:

This is in reply to the question contained in your letter of recent date.

The Associated Electronic Engineers is a non-political society of theatre soundmen, all members of the IATSE, who are trying by united effort to clarify and establish their position in the field, promote knowledge of electronics as it applies to the theatre, and to encourage its members to keep abreast of developments in our industry.

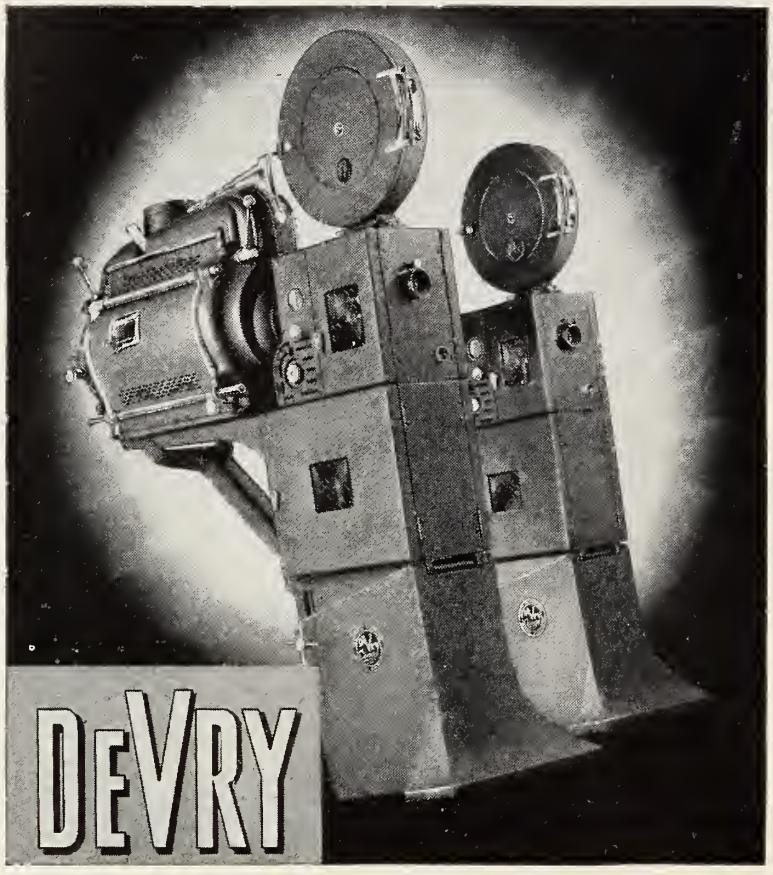
In addition, this organization endeavors to encourage a spirit of goodwill and cooperation between the soundmen and those with whom we work. We solicit the friendship and cooperation of all members of the IA, and we intend to promote and maintain an amiable relationship between our members and our employers. Recent events have shown the need for a united group, representative of all soundmen, that can be called upon by the officers of the IA and the service companies for information pertaining to our specialized craft.

While the Associated Electronic Engineers is national in scope, its headquarters are located in New York City. Meetings devoted to the business of the organization and to technical discussions are held each month. The official journal of our society, "The Thousand Cycle Loop," is published every other month and is mailed free to all members. Copies of this publication are available to projectionists who request them.

At the present time our members are represented in 112 IA local unions throughout the country, and the membership list is steadily growing. Our activities may be briefly summed up as being dedicated to our own welfare and that of our brother members, the projectionists. We have always needed each other and we shall need each other more in the days to come.

I hope this letter answers all your questions, and if you wish any other information about our organization, please don't hesitate to call upon me.

R. W. KAUTZKY, *Vice-President*
Associated Electronic Engineers



PROJECTORS WORTHY OF A PROUD NAME

A PROUD NAME in the motion picture world, DeVRY is justly proud of its new 35mm motion picture projectors for which orders are now being accepted. Into these streamlined, rugged, durable and trouble-free essentials to audience satisfaction has gone a wealth of engineering knowledge and experience. Back of their sterling performance in the theater, are new manufacturing techniques, improved machinery, broadened facilities—and the skilled craftsmanship of men who have earned their FIFTH Army-Navy "E" award for excellence in the production of motion picture sound equipment. RESULT: a theater projector that exceeds generally accepted commercial standards in every respect. Coupon will bring you facts of importance.

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Address.....
City.....*State*.....
Theater.....*Capacity*.....

LICHTMAN THEATRES' WAR BOND SALES REACH HIGH FIGURE

An official of the Lichtman Theatres, of Washington, D. C., announces that the chain, which operates 24 theatres in the district, has sold almost three-quarters of a million dollars worth of E Bonds during the first six War Loan drives. Lichtman's Washington houses, for the current loan drive, have been given an E Bond quota of $89,500, which was almost reached at the end of the first week of the drive.

George J. Miller, of the Republic Theatre, was one of the first of all D. C. theatre managers to reach his goal. Mr. Miller's theatre was assigned a $25,000 quota. This manager, as a result of a pre-campaign effort, was able to report the sale of $40,725 worth of E Bonds, and has pledged to more than double his quota.

W.E. MOVES TRAFFIC HEADQUARTERS TO NEW YORK

Western Electric Company's traffic department has moved its headquarters from Chicago to 195 Broadway, New York, the change becoming effective on April 16. The transfer was made to coordinate expanded activities with those of the company's other general departments at headquarters.

W. McCirr, traffic manager; R. C. Colton, assistant traffic manager, and other members of their group, have moved to the New York location. The company also announces that C. M. Schifferdecker, traffic agent at the Kearney plant, has been promoted to assistant traffic manager at New York. F. A. Demarest, traffic agent at New York headquarters, succeeds Mr. Schifferdecker as Kearney traffic agent.

SHORTAGES POSTPONE LIFTING OF THEATRE CONSTRUCTION BANS

Additional moving picture theatre construction in the immediate future will be prevented by critical shortages of seating, textiles, projection and sound equipment, the War Production Board announced through its Office of Civilian Requirements. Lack of manpower in tight labor areas and an insufficient supply of certain construction materials also are determining factors.

The war agency stated that the announcement was made as a result of an increasing number of applications to it for permission, under construction order L-41, to build and outfit new motion picture theatres. No available facilities exist for the manufacture of theatre seats and textile coverings, it was explained, or motion picture projection equipment for commercial use.

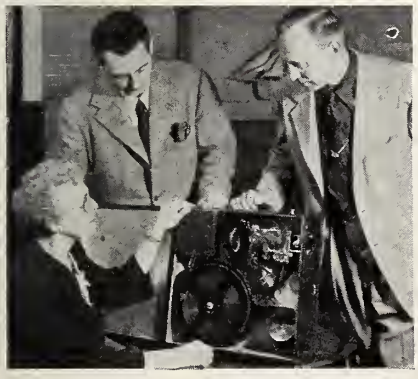
A total of 263 applications for theatre construction was considered by WPB between January and April, 1945, it was disclosed. Of this number 124 theatres were approved, chiefly to replace buildings destroyed by fires and other accidents. The agency denied 121 construction applications, and 18 cases were closed without action.

EARLY DeVRY PROJECTOR IN SMITHSONIAN INSTITUTION

The late Dr. Herman A. DeVry, more than thirty years ago this spring, emerged from the basement of his humble Chicago home with the world's first portable motion picture projector, and today this original "suitcase projector," as it was then called, is on exhibition in the Smithsonian Institution along with other outstanding contributions to the progress and profit of mankind.

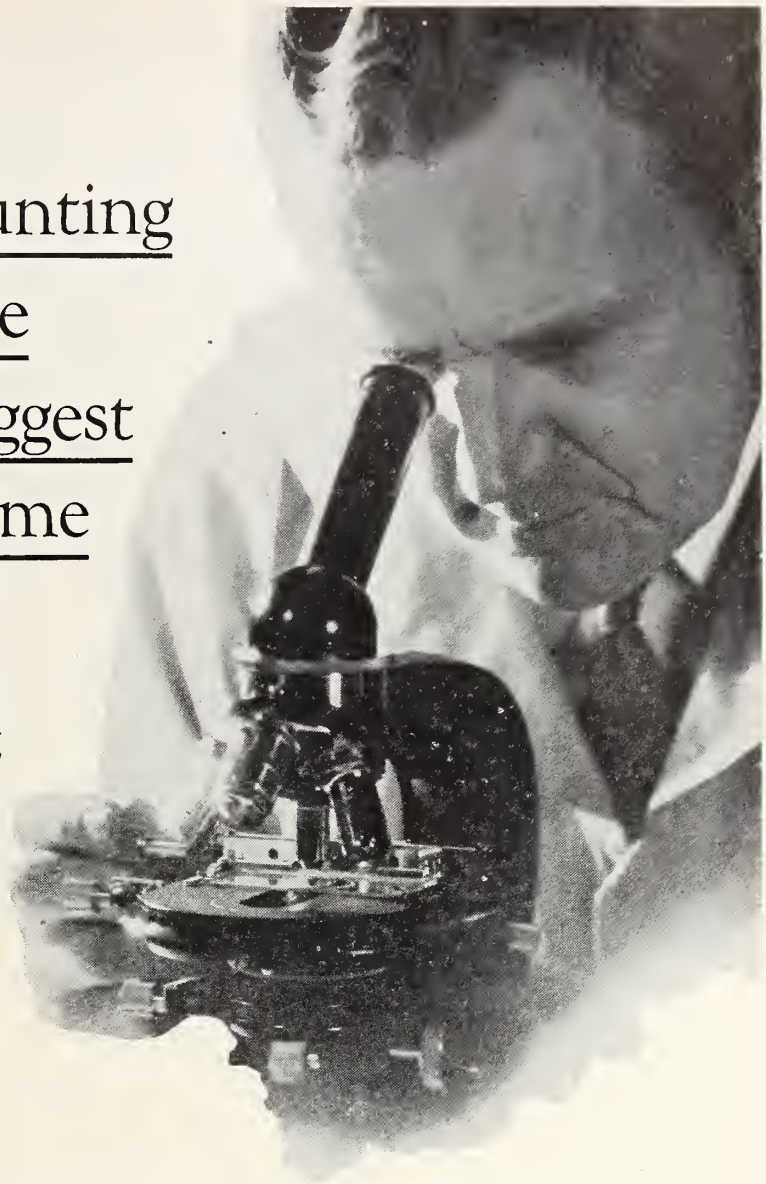
The selection of the DeVry "theatre in a suitcase" by Smithsonian is one of three honors accorded the DeVry Corporation, pioneer Chicago motion picture equipment manufacturers. DeVry employes have been awarded the fifth Army-Navy "E" flag for production excellence, and a battery of DeVry theatre projectors was installed in San Francisco for use in presenting documentary films to the delegates to the United Nations conference

The time would come, Dr. DeVry early predicted, when the number of people being instructed and informed by motion pictures would exceed those being entertained by them. Wartime uses of motion pictures to train fighters, instruct workers and for propaganda purposes in remote sections of the world have fulfilled this prediction.



Mrs. Ida DeVry, widow of the late Dr. Herman A. DeVry, with her sons, William C. and E. B. DeVry, making final inspection of the original DeVry portable projector prior to its exhibition at the Smithsonian Institution.

hunting the biggest game of all



VERY FEW PEOPLE SEE—or are aware of the important role of the bacteriologist. Working patiently, painstakingly in his laboratory, he is a saviour to mankind . . . determining the cause of a disease . . . searching for its remedy.

BEHIND THE SCENES, too, is the Altec Service Engineer. He joins his efforts with the projectionist to keep booth equipment operating smoothly . . . discovering and curing with the help of his expert knowledge and precision instruments any weaknesses that might cause a breakdown.



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The Service Organization of the Motion Picture Industry

New Continuous Projection System Invented by Canadian

CONTINUOUS projection, with the screen full illuminated at all times despite the fact that conventional shutters operate in the conventional way, has been achieved through the use of a new and ingenious principle of operation, according to the inventor, Thomas C. Hoad, a projectionist and engineer of Toronto, Canada. Hoad demonstrated his invention, which he calls "Dual Projection," at a meeting of the Toronto Managers Association.

Flickerless presentation, sharper focus, better screen light, less heat on the film and absence of eyestrain are among the advantages claimed for the new projection procedure. These results are obtained by using a projector similar to the one in use today, except that it is built with two trap members, two intermittent movements, and two lenses; it also requires a change in the present method of making prints.

The process of printing the positive is divided into two steps. In the first, every alternate frame is printed. The second step involves shifting the positive several inches along the negative and then printing the remaining frames. Thus, instead of appearing on the positive in regular succession, the frames are printed approximately in this order (beginning, for example, with frame No. 5): 5, 12, 7, 14, 9, 16, 11, 18, 13, 20, 15, 22, etc.

In projecting such a print, dual projection members are arranged one above the other, with their shutters and intermittent sprockets 180° out of phase as between the two projectors. Therefore, when frame No. 13, for example, is being projected through the lower aperture, shutters are closed in front of the upper aperture and frame No. 14 is in process of being pulled down into position in the upper gate. When frame No. 14 is projected through the upper aperture the lower shutter covers the pulling down of frame No. 15 at the lower gate.

Thus the screen is never dark. Projection takes place continuously, but not continuously through the same aperture. The frames are projected in their proper sequence, although they do not appear in the proper sequence on the positive. A loop is needed between the two apertures, since the two intermittent sprockets are 180° out of phase with each other.

In this method of projection, the inventor claims, successive frames blend imperceptibly into each other on the screen.



NEW RCA BOOK ON THEATRE TELEVISION

BUY MORE WAR BONDS

RCA, pioneer of 25 years in the field of electronics, brought television to the New York World's Fair in 1939, and to the theatre in 1941 at a large screen showing.

With a realization of the great interest created by this new great potential entertainment medium, RCA Service Company has prepared a booklet of especial interest to members of the theatre industry.

The RCA Television Handbook for Projectionists will help you prepare for TT* day through a thorough understanding of what makes TT click.

Written essentially for the projectionist, it also contains an interesting discussion of developments on this timely subject of importance to theatre management.

Based on RCA's lengthy experience in the development of theatre television, you'll find plenty of good solid information to help you become better acquainted with this most important development.

Whether you are theatre owner, manager, or projectionist, be sure you get a copy.

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*Theatre Television.

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BUILDING OF PAN-AMERICAN HIGHWAY AIDED BY MOVIES

In a letter received by the theatre and sound equipment department of RCA International Division the story was told of a portable sound film projector that "came up smiling" after being jogged off the back of a truck and bouncing several yards down a steep mountain road in Nicaragua. H. Montenegro, former representative of the construction company building a section of the Pan-American highway, is the author of the letter.

Sound films, according to Mr. Montenegro, have played an important part in maintaining morale among workers building the highway.

In unfolding his story he said that "one night, returning from the Ducuali camp to Esteli, we followed a new route by mistake, on a mountain that is quite steep. When our small truck seemed unable to continue up the grade we tried to force it. The vibration caused the case containing our projector to fall from the rear of the truck to the road, where it rolled downward several meters. Expecting to find serious results when I recovered the case, I was surprised to find that only the projection lamp had been damaged."

• BUY WAR BONDS •

AT YOUR SERVICE

(*Continued from page 20*)

plifier volume control until the meter reads any desired reference level—usually 16 to 20 db.

For this test I have used loops of 1,000 cycle film. I have also used 300 cycle test films with good results. Then leaving the amplifier volume control in the same position and substituting other photo cells for the one selected as a standard of comparison and noting the meter reading obtained with each tube, it is possible to determine the relative merit of these cells.—K. E. STEPHENSON, *RCA.*

Storing Calcium Chloride

Your theatre manager will appreciate this tip where calcium chloride is used to melt sleet and ice on pavements and around theatre doors. Due to the nature of calcium chloride, it will absorb moisture from the air, chemically known as "delinquencence." If left exposed to the air such as in open bags, it will soon absorb enough moisture to make it form a useless paste. This is a good time to caution your theatre manager about the subject, otherwise large quantities of the chemical will be made worthless when it is needed next winter. Store the material in airtight bags or containers. Incidentally, if left to form a paste it can flow or drip and may ruin other items stored near it.—R. H. BISBEE, *RCA.*

Century Model "C" Intermittent

We experienced some trouble with the Century model "C" intermittent movement. The trouble reported was noisy operation and an unsteady picture. We had three of these movements returned to us for inspection, but in each case the operation of the movement appeared quite normal when a picture was projected here. We discovered that the flange of one of the CS-30-BB intermittent housings is about 15 mils thinner than others. The clips which held the movement in the mechanisms bear against this flange with the result that when the clips are tight the movement is still permitted to rotate.

Our inspectors are requested to check each Century installation at the first opportunity. It should only be necessary to grasp the intermittent on the operating side and attempt to turn the whole casing in the mechanism.—DOMINION SOUND EQUIPMENT, LTD.

Fading in Monitor Amplifier Corrected

I experienced considerable trouble in trying to find the cause of fading in one of the monitor amplifiers. I finally located the trouble to a poorly soldered filament wire in the tube base prong.—H. M. MORROW, *RCA.*

BUY WAR BONDS

MORE THEATRES ARE GOING TO BUY



Simplex HIGH

PROJECTION ARC LAMPS

Yes, more and more, for theatres are going to buy more carefully and they look to Simplex for the latest developments.

The Simplex High delivers the snow-white light essential to satisfactory projection of Technicolor pictures—double the light of the low intensity, at only slight increase in cost.

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CLAYTON BALL-BEARING EVEN TENSION TAKE-UPS

For all projectors and sound equipments

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The Brilliancy of your PROJECTED PICTURES

— regardless of the efficiency of all other equipment, is dependent directly upon the condition of the optical surface of the reflector in your lamphouse, since any light which reaches the screen must necessarily be reflected to the screen by this surface of the mirror.

Replace your mirrors regularly with new, genuine

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NATIONAL THEATRE SUPPLY

"There's a Branch Near You"

Presenting: Morris I. Klapholz



MORRIS I. KLAPHOLZ, member of Local No. 306, New York City, and secretary of the famous 25-30 Club, knows his way around this business, as he has had plenty of varied experience. Born in Philadelphia, Penna., on November 11, 1891, he attended elementary schools there and in Boston. He graduated from high school in Keene, N. H., and later took a post-graduate course at Dewitt Clinton in New York City, where he also attended the Collegiate and RCA Schools.

In 1908 he joined the auxiliary of Local No. 35, and in 1912 acted as temporary secretary. He also was the first secretary of the old No. 1 local when it broke away from the I. A. in protest against the I. A.'s refusal to grant the local its own charter.

Klapholz was connected with the Edison Kinetephone Company in 1912 and 1913 as assistant to W. E. Waddell, and later on was associated with the DeForest Phonofilm Company. Dr. DeForest affectionately refers to Morris as "my aide in those pioneering days of Phonofilm, alias Movietone." Under Dr. DeForest's direction he developed all the a.c. operated Phonofilm, the processes being successfully defended in the courts.

In 1930 he was the technician in charge of the Motorized Talking Picture Corporation. Among his "firsts" was the opening of the New Roxy Theatre in Radio City in 1933, when he was a member of the original crew. He was also a member of the original crew that opened the Broadway Theatre with Walt Disney's "Fantasia."

Morris also did his good share of roadwork both in the United States and Canada. His last road job was with the Jam Handy Pictures Company for the Chevrolet program. At present he is employed at the Capitol Theatre, New York, where ten of the fourteen projectionists are members of the 25-30 Club.

He is a member of the retirement board of Local No. 306, and previously served on the examining board. He recently became a grandfather and spends most of his free time commuting between New York and Baltimore, the home town of his grandchild. As the secretary of the 25-30 Club, Morris Klapholz has done much to make it the splendid organization it is today.

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FOR over forty years this company has been known for its ability to discover new methods and ways to create new products, or constantly improve those in existence, in the special electrical field.

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RCA APPOINTS TWO EXECUTIVES

Brig.-Gen. David Sarnoff, president of the Radio Corporation of America, announces that Frank M. Folsom, who has been vice-president in charge of RCA Victor Division since January, 1944, has been elected executive vice-president in charge of the RCA Victor Division. At the same time John G. Wilson was elected operating vice-president of the RCA Victor Division.

Mr. Folsom joined RCA after serving in Washington as chief of the procurement branch of the Navy Department. In addition to being in charge of RCA's manufacturing division he also is a director of RCA, and of the National Broadcasting Company.

Mr. Wilson has been in charge of financial administration of the RCA Victor Division for the last year, coming to RCA from Chicago where he had been executive vice-president of the United Wall Paper Company.

IN THE SPOTLIGHT

(Continued from page 17)

the movie going public. It provided for fireproof projection room construction, adequate ventilation and two doors in every projection room.

"It is my personal opinion that the provision placing the minimum age of projectionists at 18 years really killed the bill. The theatre owners seized upon this provision and claimed that it was impossible these days to hire projectionists over 18 years of age, and that it was an attempt by the union to control the hiring and firing of projection room personnel. Of course, there was nothing in the bill to substantiate this claim, but once that seed was planted in the minds of the Assembly, and the red flag of unionism waved over their heads, we knew the bill was lost. You see, most of our representatives come from the rural areas and are opposed to organized labor.

"One small town exhibitor who appeared to fight the bill was extremely bitter about the 18 year age limit, saying that only young boys were available. I told him that if the exhibitors would pay decent living wages they would be able to get all the men they needed, but since all they wanted to pay a projectionist was a dollar a night they had to depend upon youngsters. His reply was a shout 'A dollar nothin.' I pay my boy FIFTY CENTS a night and he is glad to get it.' I guess that about sums up the situation."

These dyed-in-the-wool anti-labor exhibitors are pretty tough to crack, but we believe that stiff determination and persistency on the part of our officials will make them see the light eventually.

● We were pleased to learn that in the election held recently by the technicians and engineers of the program department of DuMont television station WABD in New York City, the IATSE was elected their bargaining agent having received 24 out of the 26 votes cast. They are now members of the Television Broadcasting Studio Employes Local No. 794, which was chartered by the IA early this month.

● More on the subject of training wounded veterans as motion picture projectionists. Local No. 225, Atlanta, Ga., in answering charges made that the union refused to train wounded veterans as projectionists issued a statement declaring that its action was based on the limited number of jobs available, and that it desired to save as many jobs as possible for its members now in the armed forces. We have been informed that other southern locals have been approached with the same demands, which were promptly turned down.

There are a number of positions in a theatre that a wounded veteran can fill—positions not as confining and hazardous as running a projection machine. If the exhibitors really are sincere in wishing to help the returning veterans, why don't they train them to fill these other positions? Could it be possible that it is merely an excuse to ease the union projectionist out of his job and eventually replace him with a non-union man at a lower salary?

● Frank Olsen, special I. A. representative and secretary and business agent of Chicago Local No 2, died after a serious illness. Frank was 53 at the time of his death, and until he was stricken several months ago appeared to be in robust health. It is believed that the loss of his son in the European war hastened his death. We extend our condolences to his survivors.

● Add one more to the rising population of Houston, Texas. Jimmy Webb, member of Houston Local No. 279 and one time contender for the light-heavyweight championship of the world, became the father of a husky youngster—weight 11 pounds stripped. You can mail the cigars, Jimmy.

● Lewis Mumaw, member of Cleveland Local No. 160, and former road secretary for the Cleveland Baseball Club, has been appointed general manager of the Arena, a Cleveland sports auditorium. Mumaw is highly regarded in sports circles and is considered a box office expert.





MOT. PIC. SOVIET UNION

(*Continued from page* 14)

in that place.

Power output, it was learned, is 20 watts for a theatre of perhaps 600 seats. There were said to be six speakers back-screen. It was impossible to get to look at them; from descriptions, helped out by gestures, they may have been cone types some 18 inches in diameter. There was no evidence of any network that would provide separate low and high frequency reproduction.

Three of the four stages of amplification were push-pull. The tubes were all of glass types and resembled the larger size American radio receiving tubes. Sockets appeared to be similar to American sockets. The rectifier tubes had double plates for full-wave rectification, but each power amplifier used two of them.

All the apparatus, according to its name-plates and insignia, was strictly of Russian manufacture. All of it must also have been strictly of Russian design; for though some items, as noted, resembled American apparatus, there was nothing that could be called a mere Chinese copy of any other equipment the present writer has even seen.

Auxiliary Details

The generator room opens directly out of the projection room as does the tool room; but the rewind room opens out of the tool room; it is as remote as possible from the projectors and can be reached only after making two full left turns.

The tool room contains only a wooden bench, equipped with a large and excellent vise that was perhaps too heavy and valueless for looters to bother to carry it away. Other equipment and tools were only a screwdriver or two, a pair of pliers, and some bits of wire. On the bench was an open pot of patching cement with either sticks or brushes protruding from it. They must be the things used for applying the cement, but they seemed very large for so delicate a job. No patching device of any kind was visible.

The rewind room is very small. It contains a little bench and a hand rewinder. A motor-driven rewinder was used before the war, the visitor was told. Spare parts were conspicuous by their absence, and there was no parts cabinet or receptacle in which they might have been stored. Not more than an evening's supply of carbons was visible. There was no film cabinet.

No source of non-synch sound was seen. (No curtain music or other non-synch sound was heard during a previous visit to this theatre.) No buzzer, telephone or other means of communication with the projection room could be seen.

Small, unshaded incandescents light the projection room and are so located as not to be in the projectionists' eyes. The region of the two projectors is kept strictly darker than the rest of the room.

Performance

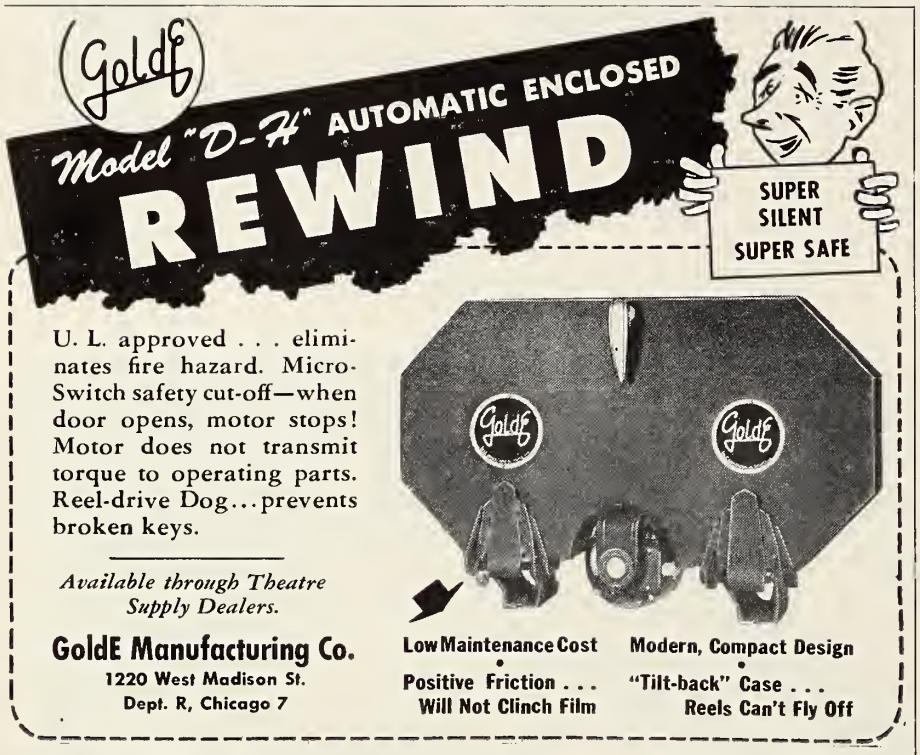
A few days before permission to visit this projection room was obtained a Russian film was viewed in the same theatre, with the help of an interpreter who explained the action.

(It was all about a handsome young Soviet engineer who was very much in love, but the gal was a "scientific worker" and had no time for love. There were complications with a spying neighbor and a letter delivered to the wrong hands and a jealous sister, but—you guessed it—it all ended happily at last.)

Judging quality of the spoken word was impossible in absence of even the slightest knowledge of the language, but the music appeared to be of fair quality, possibly somewhat lacking in bass response and perhaps a trifle too strong in highs. No trace of flutter was heard. The screen image was entirely steady. Screen illumination was poor but not impossibly bad: on the basis of its appearance at that time it should be good when the arcs are working at full current. Of course, the full 3,600 watts, or even the 1,800 watts they were then using, is fairly healthy arc power for a theatre of only 600 seats—but these lamps are said to be 1928 models.

The projectionists work a six-hour day and are paid 750 rubles a month. The purchasing power of that money cannot

(*Continued on page* 30)





OLIVER SUPPLY COMPANY IS RCA CLEVELAND DEALER

The Theatre Equipment Section of the RCA Victor Division announces the appointment of the Oliver Theatre Supply Company, Inc., Cleveland, to distribute the RCA line of theatre equipment in the Cleveland film territory. The Oliver company was purchased recently by Ben and Harry Perse, owners of the Capitol Motion Picture Supply Corporation, RCA equipment dealers in New York City.

The Cleveland business is being operated with local personnel under the management of M. H. Fritchie, who was associated with the Oliver company for some time prior to the ownership change.

"COMPRESS" MESSAGES FOR CARRIER PIGEON FILMS

Sponsored by the United States Army Signal Corps, recent improvements in sound recording have made it possible to compress long messages spoken into a recording device and reproduced on a light thin film belt into such small compass that they can be carried in capsules harnessed to the backs of homing pigeons. Approximately twenty times as much wordage can be set down in this manner as can be typed on paper of similar surface space, it is explained.

The film belt is one foot long and 3½ inches wide, of which three full inches can be used for voice reproduction. It is estimated that about 18,000 words can be put on one film belt.

Two such film belts can be inserted into a four-inch capsule such as has been developed for harnessing to a pigeon's back, so that a single bird can carry 36,000 words of spoken message.

ALTEC APPOINTS TWO

Martin M. Goulson has been named supervisor in San Francisco for the Altec Service Corp., according to an announcement by S. M. Pariseau, Los Angeles district manager. Mr. Goulson recently returned from overseas on military leave from Altec.

Mr. Pariseau also announced that Max V. Neumann has been named supervisor in Los Angeles. Mr. Neumann has been associated with the company since its inception and takes on his new position after completing an assignment with the electronic division of the company, where he was working on special devices for the Navy.

WPB REVOKES L-325 COVERING PROJECTION EQUIPMENT

The War Production Board has revoked Limitation Order L-325 which governs production and distribution of motion picture projection equipment, including sound and amplifying systems, for use in exhibiting 35-mm film. Other controls, however, over acquisition and use of materials for production of projection equipment, continue in effect.

Under L-235 manufacturers were permitted to produce 35-mm projection equipment only as specifically authorized by WPB, with the authorizations being issued in accordance with approved production programs of the war agency. Production for other than military purposes was extremely limited, and will continue to be limited by the unavailability of materials, despite revocation of the order, it was pointed out.

It was also said that sale and loan of new projection equipment no longer is subject to specific WPB authorization on Form WPB-1319.





Precision reflectors for replacement in all types and makes of projection arc lamps. For sale by most Independent Theatre Supply Dealers.

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Local No. 577, San Bernardino, Calif., claims to be the first projectionist union in eleven western states to receive the coveted "T" award for payroll bond purchases made by its members. Ernest M. McCook, chairman of the 7th War Loan campaign, is pictured above making the presentation to the union officials. Standing next to Mr. McCook, left to right, are Basil H. Davis, business agent; T. R. Benjamin, secretary, and Harry Reynolds, president of Local 577, who is shown receiving the award.

ELECTRONIC & COMMUNICATIONS EQUIPMENT RELEASED

Electronic and communications equipment and components released by the armed forces is being offered for sale by the Electronic Corporation of America, agent for the Defense Supplies Corporation, at its warehouse at 352 West 48th Street, New York City. Much of the equipment will be sold without any need for reconditioning. Other supplies will be completed or reconditioned. Catalog listings of available merchandise will be mailed to distributors and industrial users, it is announced. A sales organization has been set up by ECA to cover the entire country.

Regular catalog listings of equipment available may be had by manufacturers, distributors and industrial users by addressing the ECA at 45 West 18th Street, New York City.

MOT. PIC. SOVIET UNION

(*Continued from page* 28)

be estimated with any accuracy. In this country an ordinary ten-cent bar of chocolate costs more than a bottle of champagne. An attempt was made to find out the cost of the common Russian black bread by buying some—a transaction conducted by pointing to the bread and holding out a handful of rubles. This failed; they gave us the bread and refused payment. Nobody gave Americans any bottles of champagne without payment, so possibly bread is quite cheap. On the other hand, American soap of the three-cakes-for-a-dime variety brings 30 rubles a cake on the black market; and one silver-plated knife or fork would cost a projectionist half a month's pay. All that can be said with any reasonable certainty is that the general standard of living in wartime Russia is far below that in wartime America; it is reasonable to suppose that standards of living of the projectionists in the two countries would compare accordingly.

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NEW WESTINGHOUSE RECTIFIER TO BE DISTRIBUTED BY RCA

The new "Rectox" copper oxide rectifier developed by the Westinghouse Electric and Manufacturing Company will be distributed through the RCA Victor Division, it was announced by Homer B. Snook, sales manager of RCA's Theatre Equipment Service.

This new rectifier includes numerous improvements which assure superior service and long life, he explained. Since maintenance costs will be extremely low, according to Mr. Snook, it will prove less expensive for its years of service than the tube type rectifier. Production will start as soon as wartime conditions permit.

ALTEC SERVICE CONTRACTS

Altec Service Corporation renewal contracts, recently signed, include the following: Gene Mollwain Theatres in Lafayette and Hartsville, Tenn.; State and Grand, Elizabethtown, Ky.; the Lionel Delacroix Theatres, Plaquemine, La.; Niagara Drive-in Theatre, Tonawanda, N. Y.; Central, Yonkers, N. Y., and Globe, Republic and Terrace, New York City.

New accounts contracting for Altec service include Texan, Big Spring and Victory, Del Rio, Texas; Ausable, Ausable Forks, N. Y.; Gay, Jackson, Miss.; Virginia, Pedan City, W. Va.; Congress, Palouse, Wash.; York, Red Bolling Springs, Tenn.; Premier, Littleton, N. H., and Plaza, Waterbury, Conn.

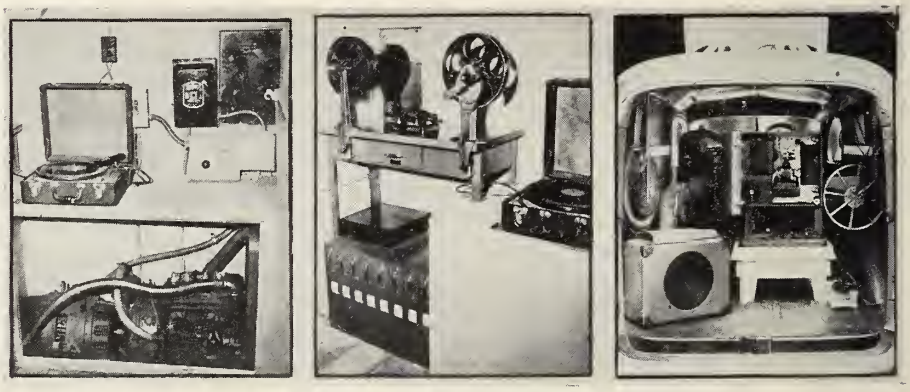
Agreements have been renewed with Altec for servicing of Fox-Wolverine Circuit theatres in Hancock, Iron Mountain, Menominee, Laurium and Houghton, Mich., and for the Fox and Strand in Marinette, Wis.

The Welfare Department, U.S.N.A.S., has contracted for Altec service for the East Side, Alameda, Cal., and for Receiving Station and U.S.N.S. Pier 91, Seattle, Wash.

Altec service and parts agreements have been renewed by the Interboro Circuit of New York, according to Bert Sanford, Jr., New York district manager. Stanley Pariseau, Los Angles district manager, announced the signing of service, sound and booth parts agreements with U. S. Naval Air Stations at Moffet Field and Splinter City, Calif.

Dipson Theatres, Inc., have renewed their contract for service in theatres in Buffalo, Lackawanna and Amherst, N. Y., and the Fox West Coast Agency has signed agreements for service in their Guild Theatre, Hollywood; Village Theatre, Claremont, and Grand Theatre, Richmond, Cal.





AUDIO-VISUAL MOBILE SERVICE UNIT

Above: *Automobile trailer body as designed by DeVry Corporation, Chicago, for use in postwar selling and servicing of DeVry motion picture sound and related equipment to theatres, churches, agricultural groups, and business and educational institutions.*

Below (left): *Built-in generator to provide independent power for projection and sound amplification;* (center) *complete film laboratory facilities for on-the-spot servicing, and* (right) *DeVry 16-mm and 35-mm projection and sound amplifying equipment as used in standard audio-visual mobile unit.*



LET'S GET THE ADMIRAL HIS HORSE!



Official
U. S. Navy Photo

Admiral Halsey has his eye on a fine white horse called Shirayuki.

Some time ago, at a press conference, he expressed the hope that one day soon he could ride it.

The chap *now* in Shirayuki's saddle is Japan's Emperor—Hirohito.

He is the ruler of as arrogant, treacherous, and vicious a bunch of would-be despots as this earth has ever seen.

The kind of arrogance shown by Tojo—who was going to dictate peace from the White House . . . remember?

Well, it's high time we finished this whole business. High time we got the Emperor off his high horse, and gave Admiral Halsey his ride.

The best way for us at home to have a hand in this clean-up is to support the 7th War Loan.

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Your personal quota is big—bigger than ever before. So big you may feel you can't afford it.

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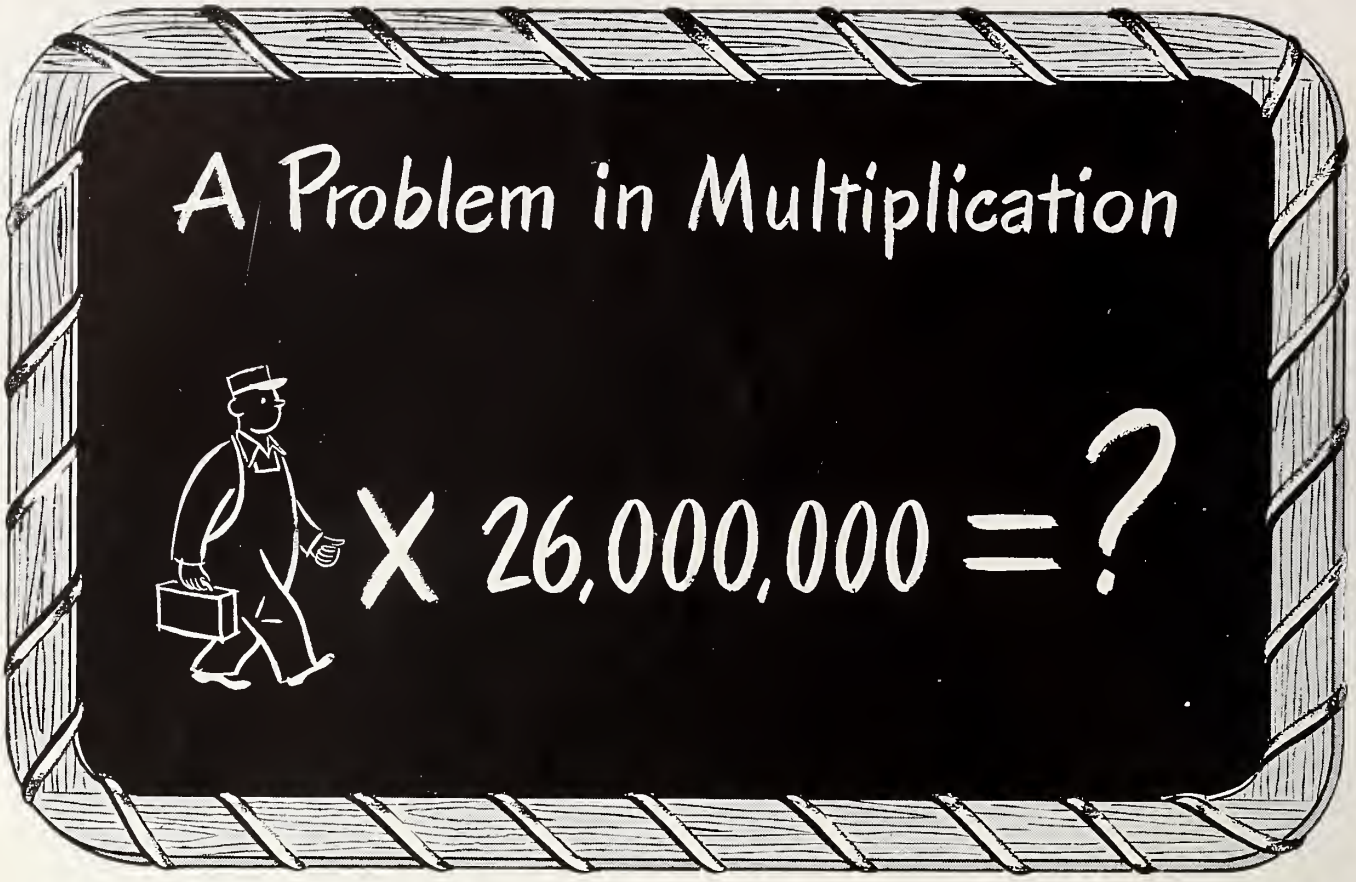
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JULY 1945

VOLUME 20 • NUMBER 7

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For a country *can't help* being, as a whole, just what its people are individually!

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The kind of future that America will have—that you and your family will have—is in your hands.

Right now, you have a grip on a *wonderful* future. Don't let loose of it for a second.

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LEFT: Bell Telephone Laboratories, New York, N. Y.
BELOW: Electrical Research Products Laboratories, Hollywood, Calif.

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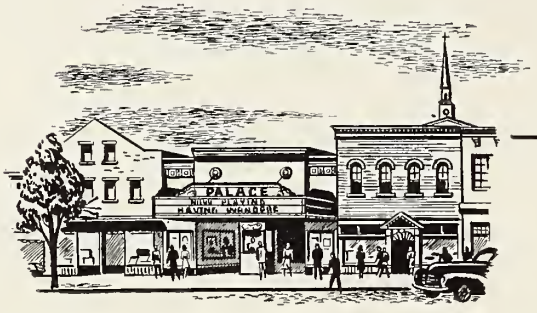
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. . . THAT YOU HAVEN'T?





LOOK! In times like these you both have good audiences, films and other things that spell good box office!

But—if you are one of the 4,000 to 5,000 U.S. theaters still using low intensity carbons, one of the most important points to consider is the improvement of the quality and quantity of your screen illumination.

There never was a better time than right now to prepare for postwar business. And you can do it . . . by switching over to High Intensity lamps.

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INTERNATIONAL PROJECTIONIST

With Which Is Combined PROJECTION ENGINEERING

W. L. Lightfoot, *Associate Editor*

Volume 20 JULY 1945 *Number* 7

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MONTHLY CHAT

A CONTEMPORARY, the British Journal of Photography, points to increasing candor in the publication by scientists, engineers, inventors, etc., of their discoveries, with less and less secrecy in evidence. It also mentions, however, that all scientific research is not published, with the "mistakes" made more often than not being withheld from the light of the printed word.

The argument is given that immeasurable time could be saved if the mistakes as well as the successes reached the printed page so that others would not go over ground that has proved fruitless with the concomitant of "terrible waste of time, money and materials."

In our field the Society of Motion Picture Engineers, as well as others, have led the way in this type of candor, and it is to be expected that in time greater realization will be held by the organized groups as well as individuals that all will be served better if mistakes are brought to light. With television looming as the next great project, I.P. believes it will be well for all researchers to effectively tell of their mistakes as well as their successes to the end that time, effort and materials will be saved to the greatest possible extent. Infinitely more will be accomplished in the final analysis through such a sensible procedure.

• • •

During the third quarter the allotments of 35-mm motion picture film for the production of entertainment pictures will total 271,000,000 linear feet, and the allotment for newsreels is 56,860,219 linear feet. According to the War Production Board the amount of 35-mm film to be made available for entertainment pictures in the third quarter will be an increase of 10,000,000 linear feet over the second quarter, and 15,000,000 feet over the third quarter total. The newsreel film uppage is 4,000,000 feet over both the first and second quarters.

Some of those in the industry may believe the increases indicate a big opening up in the supply situation, and less need for film conservation. This is far from true, and it is just as essential now that projectionists observe maximum conservation efforts in the future as they have in the past. Much film has been saved by the thousands of conscientious projectionists who realize the war must be fought on the home front just as well as in the combat areas. The real patriot will do as much as possible to keep the show going with a minimum of waste until the last Jap hollers the Oriental equivalent of "uncle." That happy day for us, according to military experts, is far in the future.

Meet the Men and Women Who Turn Out Many of the Navy's Movies...

...THE TECHNICIANS AT ANACOSTIA

THEY were in the industry before the war... in the processing labs, or working with sound, animating, editing... in one way or another whipping exposed film into finished productions. That's what they're doing now in the Photo Science Laboratory at Anacostia, D. C. Their peacetime productions entertained or sold. Now, their Navy-made movies inform, inspire and instruct the officers and men of our fleets. Anacostia's technicians are an important part of the Navy's never-ending training program; their movies help make and keep our Navy great.

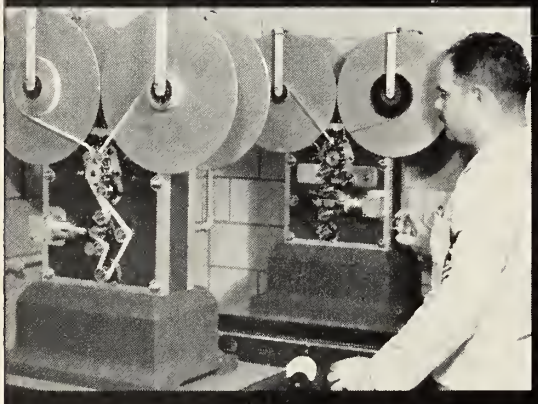
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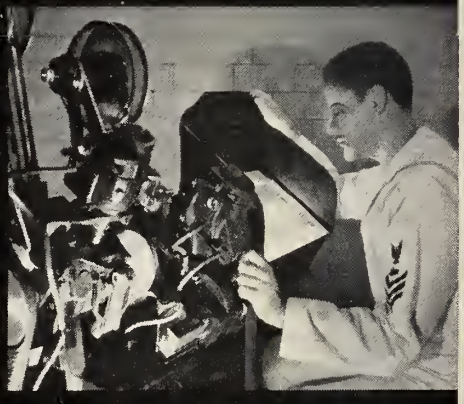
and rushes them back home to the Photo Science Laboratory at Anacostia, D. C.



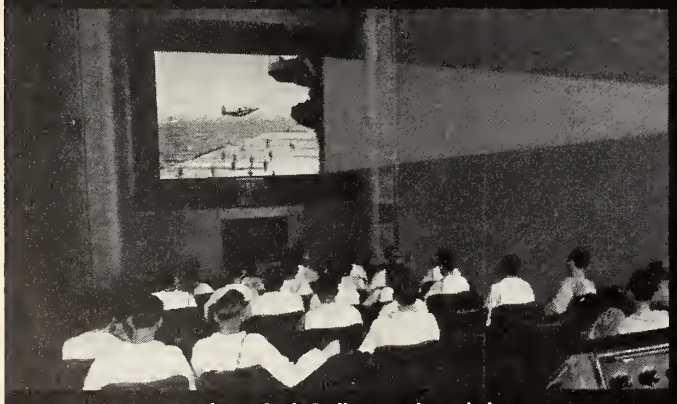
Here movie technicians whip this film footage into finished productions.



They process... edit... title...



dub in speech, music, sound effects



...after a fault-finding preview, their latest productions are OK'd for release



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J. E. BRULATOUR, INC., *Distributors,* Fort Lee, Chicago, Hollywood

One of a series of advertisements by KODAK testifying to the achievements of the movies at war



INTERNATIONAL PROJECTIONIST

VOLUME XX JULY 1945 NUMBER 7

A Step-By-Step Analysis of the Filmosound V 16-mm Amplifier

By *AARON NADELL*

Herewith is presented a step-by-step analysis of a 16-mm schematic. Operation and maintenance of the projector of which this amplifier is a part were detailed in the June issue of I. P.

CIRCUIT arrangements that are moderately novel in sound service, and some unusual mechanical details, will be found in Figure 1. Some of these features will need not only careful study, but a little reference to the actual equipment before they can be clearly understood. These will be noted as they are encountered.

Line power input is applied at the bottom, center. The primary of the input transformer is provided with three terminals which are wired to a three-point receptacle. A "polarity changer" or d.c. to a.c. converter is used with this amplifier where only d.c. line power is available. The three-terminal power input is intended for operation with that converter, the circuits of which may be examined in some future issue. Where the input is line a.c., only two terminals are used, in the ordinary way. The primary circuit completes its path through a switch and a 2-ampere fuse.

The left-hand secondary heats the filament of a rectifier tube, tube No. 7; the center secondary supplies the plate of that tube; the right-hand secondary heats all the other cathodes of this amplifier (but not the exciter lamp filament). In accordance with common practice, to reduce strain on the cathode insulation and to reduce hum, the center tap of the right-hand secondary is grounded. Trace up, right to the first junction point, up, and left as far as possible to ground.

Tube No. 7 functions as a conventional full-wave rectifier. The two plates being connected to opposite ends of their secondary winding, one is always positive while the other is negative, and the electron circuit through the tube is closed to whichever is positive at the moment. That plate (and its associated end of the transformer secondary) is the most positive part of the circuit at the moment, and since it connects to cathode through the electron stream, cathode is the next most positive point; and the center tap of the secondary is negative with respect to cathode. Cathode and center tap are, therefore, positive and negative terminals, respectively, of the d.c. output supplied by this rectifier.

The Ground Bus

The center tap of the plate secondary (like that of the right-hand secondary) is grounded. Trace to ground as before. The practical negative terminal of the d.c. plate supply, therefore, is ground, or chassis. The positive terminal is the junction point at the right of the rectifier tube filament.

The ground terminal of the diagram is drawn, as may be noted, at the left-hand end of a line which runs almost all the way across the drawing from left to right. Also, from the ground terminal trace straight up as far as possible, and then right across the top of the drawing.

These two lines leading across the drawing, together with the vertical line that connects them, may be regarded as the ground bus of the diagram.

Plate and screen grid d.c. supplies to the tubes, and anode bias to the photocell, need, therefore, be followed only along the positive side of their circuits. For the negative side, it is sufficient to trace the cathode of tube or cell to this ground bus, since the true negative terminal, the center tap of the plate secondary of the power transformer, is also connected to that bus.

Note further that the lower end of the output transformer secondary runs directly to the ground bus. It will be seen later that one leg of the inverse feedback circuit is provided by the common ground, and so only the ungrounded side of that circuit need be traced.

It is always helpful, in dealing with any drawing, to try to identify any common ground (or common positive) which the draftsman may have put in, in such

a way that it is easily recognizable. Thereafter, individual circuits can be traced to that bus, instead of all the way back to their source, which is simpler, saves time, and helps avoid confusion.

Plate Power Supply

From the right-hand side of the rectifier tube filament trace right, up to the first junction point, right, up as far as possible, right, and through the two halves of the transformer primary to the two plates of the output tubes.

From the rectifier tube filament as before trace right, up, right, up to the first connection point, left, through *A* 1254 and left to the screen grids of the two output tubes.

Following exactly the same path, continue left after passing through *A* 1254, left through *A* 330, and up to the two plates of tube No. 3.

Still following the same path, continue left after passing through *A* 330, then down, left through *A* 337, up at the next junction point then left to the plate of tube No. 2.

Again on the same path, follow left through *A* 337, up to the first connection point, left through *A* 1285, and up to the screen grid of tube No. 2.

The oscillator tube and the PEC are on a slightly different line. From the right-hand side of the rectifier tube filament trace right, up, right, then down through *A* 1700, left, and down to the next junction point. From that point trace left through *A* 1360 to the screen grid. From the same point trace down a trifle, and left through the 36 ohm plate coil to the plate.

Note that resistor *A* 1361 is marked 39,000 (39 M) ohms. 5%. The 5% means allowable tolerance; namely, if the resistor is found to have any value between 37,050 and 40,950 ohms it may be considered in good condition.

Incidentally, it should be noted that some small tolerance must be applied by the projectionist in comparing the voltage readings of this diagram to those he may take in the actual equipment. Since his voltmeter and the one the manufacturer used probably will not be of the same ohms-per-volt rating, some discrepancies are to be expected, and if of a minor nature should not be considered a sign of trouble.

For the PEC anode bias, trace from the right-hand side of the rectifier tube filament right, up to the first junction, left, up through *A* 1556, left as far as possible and up through *A* 916.

These plate supply lines are bridged to ground at various points by capacitors which serve as filters in association with the series resistors of the line. The same capacitors and resistors in some cases do double duty as recoupling devices; the resistors tending to keep speech current out of the power supply while the capacitors provide speech current with a more direct path to ground. Furthermore, the series resistors serve to reduce the line voltage from the 317 volts applied to the output tube plates to the 220 volts and 86 volts of tube No. 3 and finally to the 61 volts at the plate of the input tube.

In this diagram those condensers that are drawn as parallel rectangles, instead of parallel lines, are located in condenser banks. A small symbol, a triangle or a cross within a circle, placed near the condenser, identifies the bank in which it is to be found.

There is only one suppressor grid in Figure 1—in tube No. 2. It is tied directly to cathode and, therefore, at cathode potential.

The control grid of tube No. 2 may be traced to ground through *A* 213, right through *A* 63, and up to the bus through *A* 1553. No d.c. can flow through these resistors since they are isolated by the negative grid and by condensers; there is no d.c. voltage drop across them—no voltage drop between grid and ground. Grid is at ground potential.

Cathode of the same tube returns to ground through the 4,700 ohm cathode resistor *A* 1260 and straight down to the ground bus. Since plate current completes its course to ground through that resistor, a d.c. voltage drop does exist across it, and the diagram notes that this drop is 1.7 volts. (Query: then what is the value of plate current?) Cathode is 1.7 volts more positive than ground, or, to say the same thing another way, grid is 1.7 volts negative with respect to cathode.

No external bias is applied to the oscillator tube, No. 6. From grid trace left, down through *A* 1554, right through *A* 1698, up, and right to cathode.

The left-hand cathode of tube No. 3 goes to ground through *A* 119, and the diagram notes that the voltage drop through that resistor is 1.3 volts. The left-hand grid of that tube goes to ground through *A* 1550, in which no d.c. flows and which, therefore, has no d.c. voltage drop. Grid consequently is 1.3 volts negative with respect to cathode.

The right-hand cathode of that tube goes to ground through 103,300 ohms, and is 92 volts positive with respect to ground. Grid, however, is not 92 volts negative with respect to cathode, because grid does not go directly to ground. It can be traced right, up through *A* 349, and left to the negative side of the 3,300 ohm resistor. It is negative with respect to cathode by the extent of the voltage drop through that resistor, which is roughly 1/30th of the total drop of 92 volts, or about 3 volts.

The combined plate currents of the two output tubes return from their cathodes to ground right through *A* 1701, 250 ohms, and up to the bus. The two grids of those two tubes return to ground through their respective grid resistors, from the grid of tube No. 4 trace left and up to the bus through *A* 295; from the grid of tube No. 5 trace left and down through *A* 295 (the same part number but not the same part, obviously) to the bus. Consequently both these grids are negative with respect to cathode by the extent of the voltage drop through the cathode resistor, *A* 1701.

The bias is shown in the diagram at the point where the cathodes join—19.5 volts.

The Oscillator Circuit

The oscillator tube in the lower left-hand corner, tube No. 6, has a coil in series with its plate, and that coil is "tuned" by a .001 mfd condenser connected across it. The control grid of the same tube has a coil in series with it, and that coil is tuned by a series condenser, *A* 1551, of .0001 mfd and resistors *A* 1554 and *A* 210. As drawn, plate and grid coils are in inductive relation to each other, and the tube is of the screen grid type, wired as a screen grid tube.

This is a Hartley oscillating circuit, with feedback between plate and grid secured by the inductive relationship of the two coils. It generates a.c. for the same reason a sound system "sings" when the microphone is placed in front of the loudspeaker—direct feedback. The frequency generated depends on the constants of the circuit, particularly the inductance and capacitance of the tuned circuit, and in this case, according to the manufacturer, it is 60,000 cycles. Since that frequency is far beyond the audible range, it can be applied to the filament of the exciting lamp without creating any a.c. disturbance in the sound.

The exciting lamp, however, requires low voltage and relatively high current, and the a.c. generated is rather of high voltage and low current. That is obviously a job for a stepdown transformer, and the coil in the extreme left-hand corner, of .24 ohms, is the secondary of that transformer. Examination of the apparatus will show whether it is the grid or the plate coil, or both, that act as primaries. Secondary output is 60,000 cycles at 3.5-3.75 volts, 0.75 amperes.

Assume that the little jack shown inside the dotted rectangle is closed in such way that the plug is inserted in contact with the shielded lead. Then the .24 ohm coil is a source of 60,000 cycle a.c., and the exciter filament the load connected across that source. From the right side of the coil trace straight up, right, down and left to the right side of the lamp. From the left side of the coil trace up through the shielded lead (the ungrounded side of the circuit) and right—with the little

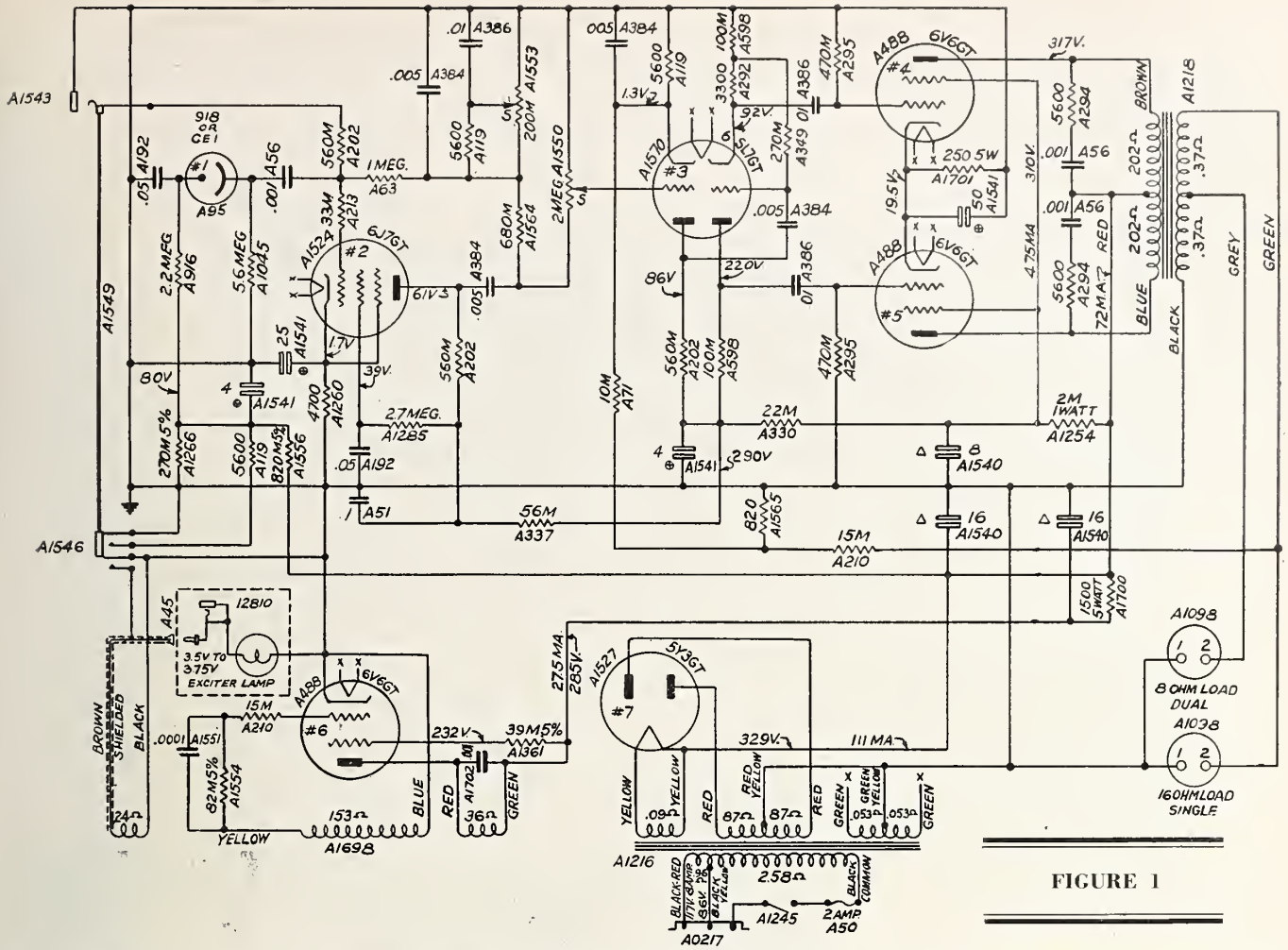


FIGURE 1

jack plugged in—up and right to the left side of the lamp.

Inside the dotted rectangle, just above the plug-in connection, there is a small jack seemingly permanently short circuited. Actually, when a plug is inserted in the sleeve of this jack (jack 12810), the tip is lifted leftward away from the short circuiting connection, and anything connected to the plug is then in series with the exciter lamp current. A rheostat can be used for remote control of volume since it will operate to vary exciter lamp current.

The shielded lead plug-in arrangement below and left of jack 12810 was illustrated in the previous article describing this equipment. The picture referred to (page 9, Figure 7, June 1945 issue) showed that shielded lead being removed from the amplifier in order to take the amplifier out of the projector carrying case for servicing.

Speech Input Circuits

When the photocell, tube No. 1, is suitably illuminated through a moving soundtrack, it becomes a source of speech current (fluctuations, at speech frequency, in its plate current, which may be regarded as an a.c. component superimposed on the d.c. plate current). Anode and cathode of the cell are the source terminals of this a.c., and a load circuit can be traced down from cathode through 5.6 megohms, left, up, and right to anode through .05 mfd. The voltage drop of a one microampere fluctuation through 5.6 megohms would be 5.6 volts.

Grid and cathode of tube No. 2 are connected across that speech voltage through *A* 56, .001 mfd to grid, and *A* 1541, 25 mfd, to cathode.

The reason for using so large a value as 25 mfd in shunt to the cathode resistor of this input tube is not altogether clear, but like the 33,000 resistor *A* 213, in series with the grid, may be intended as extra assurance of stable operation in a tube of very high gain coupled to a very high impedance input.

In the upper left-hand corner of the drawing there is a jack, *A* 1543, through which a high impedance microphone or phono pick-up may be substituted for the photocell. As drawn, the jack seems to be permanently short circuited, because the sleeve is wired directly to the ground bus (trace straight up) and the jack appears also to go to ground; trace down to *A* 1546, right, and up.

However, the line running straight down from the tip of *A* 1543 to the sleeve of *A* 1546 is not an electrical connection. The fact that this line is numbered *A* 1549 shows that it is a part, not a wire; but this is one of those numerous cases in tracing schematics where doubt may have to be resolved by looking at the actual equipment. Part *A* 1549 is not a connection but a part that causes the two jacks, *A* 1543 and *A* 1546, to act in unison. When a plug is inserted in *A* 1543 the switch points *A* 1546 close.

Reducing PEC Voltage

The lower switch points of *A* 1546 then put a direct short circuit across the .24 ohm coil supplying the exciter lamp. The upper pair of contacts of *A* 1546, when closed, put a by-pass resistor across the photocell bias, reducing that bias to a very low value and thus eliminating any chance of PEC hiss while the microphone is being used. From the anode of the PEC trace down through *A* 916, right, and down through 5.600 ohms and left to a prong of *A* 1546. When that prong is closed to the line just above it continue to trace, a little to the right, and up to ground. The effect of bridging this line to ground through a resistance of such (comparatively) very low value at 5,600 ohms is to reduce the PEC voltage far below the 80 volts shown in the drawing. This is a point to be remembered in trouble shooting.

The change can readily be calculated by Ohm's Law. Return to the right-hand side of the rectifier tube filament, where

the output is shown as 329 volts and trace right, up, left and up to the bottom of *A* 1556. Voltage at the lower end of *A* 1556 is therefore 329. Follow up through that resistor, left, down through *A* 119, left, through the closed contacts of *A* 1546, and right and up to ground. *A* 119 and *A* 1556 are connected in series across 329 volts, and by Ohm's Law the current through them will be 329/825.600. But this same current, multiplied by 5.600, is the voltage drop across *A* 119 alone; so the calculation becomes, 5.600 × 329/825.600; or a drop of roughly 2.24 volts across *A* 119.

Now the lower end of *A* 119 goes to ground through the closed contact of *A* 1546 when that contact is closed; and the upper end of *A* 119 can be traced to the anode of the cell—left and up through *A* 916—therefore, the cell receives a bias of 2.24 volts instead of 80 volts when *A* 119 is connected across the circuit as a bleeder.

The grounded side of the speech input through microphone jack *A* 1543 can be traced: from sleeve direct to ground; from the cathode to ground through 25 mfd. as before.

The grid side may be traced from the tip of *A* 1543 right, and down through two resistors to grid.

Tone and Volume Controls

Considering cathode and plate of tube No. 2 as sources of amplified speech current, trace from cathode to ground as before. From plate trace right through .005 mfd and up through *A* 1550 to ground. The amplified speech voltage will appear across *A* 1550. Any desired portion of the speech voltage drop across *A* 1550 can be tapped by the slider and applied to the left-hand grid of the next tube. In other words, taking *A* 1550 as the source of speech voltage for the next stage of amplification, one side of the line will be through slider to grid; the other side through ground and down through *A* 384 to cathode. *A* 1550 is therefore a volume control.

But the voltage across this control is by-passed to ground by an arrangement of resistors and condensers which acts as a tone control. From the lower end of *A* 1550 trace down, left, and up through *A* 1564. From the upper end of that resistor three paths run to ground: one through *A* 384; one through *A* 119 in series with *A* 386, and one through *A* 1553.

The connection through *A* 384 will detour and short out a fixed degree of high frequency response, but when the slider of *A* 1553 is all the way down, a still easier path for high frequencies exists through *A* 386 to ground. As the slider is raised, however, this path becomes of progressively higher impedance and the highs begin to find their way through *A* 119 to *A* 386, as well as through the portion of *A* 1553 which may lie below the slider. The effect is that of a tone control.

By virtue of the insertion of *A* 63, one megohm, inverse feedback is applied to the grid, and this tone control also acts on the speech input to tube No. 2, as well as on its output.

Other Speech Circuits

Speech output taken from the tone control, *A* 1550, is applied, as has been said, to grid and cathode of the left-hand half of tube No. 3. Regarding plate and cathode of that tube as sources of an amplified speech voltage, trace from plate right, up through *A* 384 (not the same part as the *A* 384 previously encountered, but only one with the same part number and therefore of the same characteristics) and left to the right-hand grid of the tube. From the left-hand cathode up, right, up through the condenser, right along the ground bus, and up through two resistors in series to the right-hand cathode. Tube No. 3 is, therefore, a two-stage amplifier, and the output of its left-hand section is connected across the input of its right-hand section.

From the right-hand plate of that tube trace down and right through *A* 386 to the grid of tube No. 5. From the right-hand cathode of tube No. 3 up through two resistors, right along the ground bus as far as possible, down, and left through 50 mfds to the cathode of tube No. 5. Tube No. 5 input is, for that reason, connected across any fluctuation in the plate-to-ground voltage of the right-hand section of tube No. 3. Tube No. 5 input is *not* connected across the d.c. plate voltage of the right-hand half of tube No. 3, because d.c. is blocked off by the condenser *A* 386, between the plate of the one tube and the grid of the next.

The grid of tube No. 4 runs through a similar condenser to the cathode of the right-hand section of tube No. 3, which cathode, it will be remembered, is 92 volts above ground, but this is d.c. voltage blocked off by the coupling condenser and has nothing to do with the d.c. grid bias of tube No. 4. That bias was previously traced and calculated. The cathode of tube No. 4 returns, through the 50 mfd of *A* 1541 to ground, and therefore to the ground side of the two series resistors drawn above the right-hand section of tube No. 3, *A* 292 and *A* 598. Tube No. 5 input is, therefore, connected across

(*Continued on page* 24)



Charles Sherman, member of New York City Local No. 306, and Past Commander of University Heights Post 89, Jewish War Veterans of the U. S., Bronx, N. Y., passes a Memorial Day wreath to Chaplain Julius J. Nodel, U.S.N., at the Norfolk Naval Operating Base. The wreath was a tribute to Ensign Rubin Keltch, U.S.N.R., who went down with the U.S.S. Plymouth after having rescued several shipmates trapped in the engine room when an enemy torpedo crashed into the port side amidships and exploded. The wreath was dropped at a point about 150 miles off the North Carolina coast where the Plymouth sank.

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The Projection of THOMASCOLOR MOTION PICTURES

By *L. R. KISTLER*

RICHARD THOMAS ENTERPRISES, INC.

Further details of the full-color projection system known as Thomascolor, the ingenuity of which will interest every projectionist, are herein presented. The many advantages of the system are strongly portrayed by the writer in the accompanying article. Practical projectionists, however, will readily note that the Thomascolor method requires four times the optical magnification of ordinary projection, and involves other practical difficulties which will be obvious to experienced members of the craft. I. P. will watch with interest, and report as promptly as possible further developments in this highly interesting and in some ways revolutionary method of producing full-color motion pictures.

MOTION pictures in the new Thomascolor[1] process of photography raises the question whether special technical skill is necessary over that of an experienced motion picture projectionist. The answer is no!

The difference in the Thomascolor method lies entirely in the camera lens and in the projector lens. Standard black-and-white film is used for both photography and projection. The Thomascolor method is completely perfected, refined and adapted for use with standard motion picture equipment in photographic, laboratory and projection work. In all these departments the necessary original installation adaptations require but a few hours time at the most.

The Thomascolor projection lens is approximately the same size as an ordinary lens and has the same latitude of operation. Length of throw, size of picture, and focal length are changed with the same facility as with a standard lens. Focus adjustments may be made with the same comparative ease as with a regular lens. The Thomascolor lens requires no physical change in the projector equipment other than fitting. Once adapted to the machine it can easily be slipped in and out and replaced with a standard lens. The lens is completely optical and photographic and, therefore, does not involve the use of any moving parts.

The projectionist should approach the Thomascolor lens with confidence for he is already acquainted with the basic principles of its operation. It is, in fact, three lenses which are the same as to coverage, resolution, color correction and aberration. They are matched for focal length and image size. In other words, the three lenses are identical in *every* respect. They all will project identical images as to size upon the screen, and will transmit the same amount of light. All three lenses transmit and project light from the same source and they all focus to the same sharpness.

The Thomascolor patents cover a multiple element lens which may be made to project and superimpose a number of images. Although it is made as a four-element lens, under ordinary projecting conditions the three primary spectral colors are used and, consequently, only three of the lens elements come into use. For the sake of simplification, the Thomascolor process is described in this article as a three-color process and the lens as a three-color lens.

Slight Variation in Film

The motion picture film used in the projection of Thomascolor is the same in every respect as the standard film except that in place of each single 35-mm frame, there are three frames a little larger than 16-mm in each 35-mm space, and one blank unphotographed frame. These three diminutive frames are identical as to frame and image size. They differ one from the other only in their color record.

Looking from the projector light source through a single 35-mm frame, there appears on the left of the projector aperture two identical frames, slightly larger than 16-mm. On the right and at the bottom appears a single slightly larger than 16-mm frame with an opaque blank above it. The frame in the upper left corner is a record of the blue light from the photographed subject, the lower left is a record of the green light from the subject, and the lower right is a record of the red light from the same source. When these three images are projected on the screen simultaneously and in register, the result is a full natural color picture of the subject.

Since each of the three frames is photographed through a different color filter, each frame is a record of one of the primary colors of the solar spectrum—either red, green or blue-violet. Filters are of the same color in both the camera and projector. Each frame is projected through the same color used in photographing. For instance, the frame photographed through the red filter is, in turn, projected through a red filter.

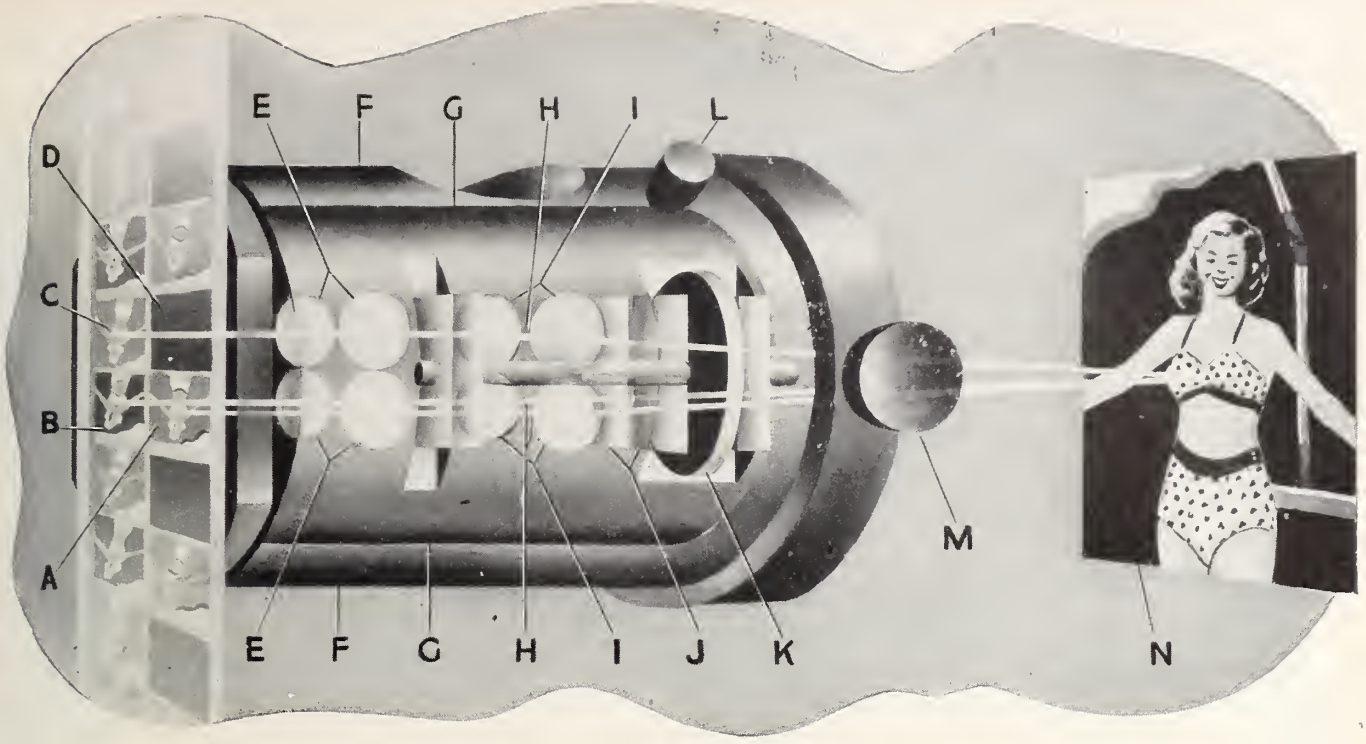
In effect, this is what happens in taking and projecting a Thomascolor picture. The camera takes the picture apart and records each color separately. The projector then reassembles the picture on the screen in full natural color—Thomascolor.

On the projection frame which carries the record of the red light which comes from the photographed object, all the full red tones appear transparent on the film, thus allowing the light to pass through without interference. As the amount of red in a particular part of the picture diminishes, the tone on the film becomes more opaque or blacker, allowing less of that color to pass through the lens system and reach the screen. Thus, ranging from complete transparency to total opacity (or blackness), all the intensities of red can be thrown upon the screen. The same



An enlarged section of Thomascolor positive film. On the left of the film is the sound track. The upper left is the red projection frame; the lower left is blank and used for special effects and other purposes; upper right is the green frame, and the lower right is the blue-violet frame.

[1] I. P., October 1944, p. 7.



In order to simplify the explanation of operation, the Thomascolor lens is herein described as a three-element lens, although it actually is made up of four elements. The fourth element and the blank frame can be used to add a fourth color to the picture or for trick photographic shots. For ordinary projection only three of the frames and three of the elements are used.

The illustration above is a diagram of the Thomascolor lens in operation: (A) red projection frame; (B) green projection frame; (C) blue-violet projection frame; (D) blank frame for special purpose use; (E) rear lens elements; (F) Thomascolor lens holder; (G) Thomascolor lens; (H) Light paths; (I) front lens elements; (J) color filters; (K) critical focus adjustment; (L) lock screw to lock Thomascolor lens in place in holder after it has been put into pre-focus adjustment; (M) register screw for bringing images into super-imposition on the screen, and (N) Thomascolor picture on the projection screen in full natural color.

is true of the other two primary colors.

It might be explained here that the primary colors of projected light are exactly the opposite, or complementary, of the primary colors of pigments. We learned at school that in mixing colors in a paint box we used red (a magenta red, not an orange red), yellow, and blue (cyan or peacock blue) as a basis for all the colors with which we are familiar.

In Thomascolor, or projected light, the spectral primaries are used. These are red, green, and blue-violet light. These three colors may be mixed in innumerable ways, giving us all the different hues, tints, and shades. Thus, red and green light in equal amounts will result in a yellow light; combining red and blue-violet light gives a magenta light; green and blue-violet light will produce cyan or blue light. A pure white light is obtained by combining green, red, and blue-violet lights.

In projecting the picture on the screen, let us consider first what happens from the standpoint of the red frame only. The light passes through the image in the lower right corner of the film, which we know is the red record. It passes the film only in those places and to the same degree as the light which came from the object photographed.

Where the object was totally red, the film appears transparent. As the red in the object diminishes the film becomes darker, thus cutting off the amount of light allowed to pass through the red lens system. In places where the film is totally black the light is completely cut off and no light is allowed to reach the screen from this point on the frame. Consequently, none of that color reaches the screen at that point.

The light then leaves the film plane and enters a rear element which conducts it to the red lens system. Leaving the lens system, the light passes through a red filter which colors the image. It is then projected on the screen where, viewed separately, it would appear as a red picture of the object with many of the details incomplete or totally missing. Only those parts of the object colored red would appear on the screen, and only to the degree in which the color was present.

The same succession of incidents is occurring at the same time to the light coming from the green and the blue-violet frames. As the three images come to focus on the screen, *and only on the screen*, they are brought together, or registered. The superimposition or register is perfect, without a trace of color fringing of any kind. The result is a beautiful picture in full natural color, in perfect register and sharp focus.

The register of the three-picture images is made possible by moving all three lenses toward a fixed point at the same time and to the same degree. This movement is simultaneous and the process of movement is called synchronization.

Registration can be effected while the projector is in operation and with the same facility as with a regular lens. This is done by means of a knurled knob on the side of the Thomascolor projector lens which causes the three lens systems to move in unison. The superimposition is automatic and infallible. The register is set, of course, at the time of installation. The lens is installed, adjusted and tested.

It should not be necessary to readjust the lens except in an emergency, such as the stretching or shrinking of film. In such cases, a slight turn of the knob will put the picture back in register. Due to the fact that stretching or shrinking is uniform over the entire surface of the film, frames and images always remain in the same *relative* position. Therefore, a skilled projectionist can operate the Thomascolor lens with only a few minutes instruction.

It is not necessary to increase the am-

perage in order to show a Thomascolor picture. The Thomascolor lens can be substituted for the standard lens without increasing the light at its source. Results comparable in screen brightness to well projected black-and-white pictures can be obtained without increasing the power at its light source.

There is less grain perceptible in a Thomascolor picture than in an ordinary picture because imperfections in the film are filled in by the multiple image projection. The simultaneous superimposition of all three images insures that an imperfection will not recur in the same place on all images as the picture is filled in at every point.

Prefocus is accomplished with a Thomascolor lens by means of an ingenious lens holder. Each Thomascolor and each standard lens to be used by a projector operator is mounted on a holder, put on the machine, brought to focus and locked into position. The lens and its holder may then be removed from the machine as often as necessary without disturbing the focus of the lens. The holders with their lenses mounted and in focus can be changed immediately.

The projector sound equipment is in no way disturbed. The sound track on the Thomascolor film is standard in every respect, and its function, control and adjustment remains the same.

In closing it should again be stressed that Thomascolor projection offers no mysteries. It is simple and direct and can be mastered quickly by the average projectionist. It contains but one adjustment not found on a standard motion picture lens—that of register. Having learned how to make this adjustment, the projectionist will be able to present perfect showings in full natural color from black-and-white film, and without the use of any dyes or coloring matter.

Many questions may arise in the minds of the readers of this article, regarding this full-color process and they are invited to send their questions in care of the editor of I. P. Other aspects of Thomascolor projection will be discussed in future issues of this publication.

As the production program gets into swing, all the standard lens sizes and focal lengths will be provided, with special projection lenses to fit unusual conditions manufactured to order.

ALTEC APPOINTMENTS

Martin M. Goulson has been named supervisor in San Francisco, according to S. M. Pariseau, Los Angeles district manager of the Altec Service Corporation. Goulson recently returned from overseas on military leave from Altec. Max V. Neumann has been appointed supervisor in Los Angeles, it was further announced. Neumann has been associated with Altec since its inception and is back in his new assignment after completing an assignment with the Electronic Division of Altec where he has been working on special electronic devices for the Navy.

Sound Failure at Fine-Wire Contacts

THROUGHOUT any sound system wire approximately as fine as human hair may be used for many purposes—in the windings of speech transformers, in high resistance potentiometers, rheostats and pads, in high impedance speakers or headphones, in meters, and so on. In every case these very fine wires must be joined to more normal-size conductors, either by soldering or by mechanical means. Such points of junction offer a special invitation to the demon of trouble, and should therefore be particularly suspected in checking for the location of an open.

If the connection is made by solder, two different causes can result in a future open, where such thin wires are involved. The mere heat of soldering may in some cases soften the thin wire to the point of melting or slightly melting; with the result that after the contact has cooled, less than a hair-thin thread of a connection may be all that maintains circuit continuity. Thereafter any relatively high surge of current may open the circuit completely. Additionally, any slight trace of corrosion resulting from the soldering process may bite almost through a hair-thin wire, again leaving only an inadequate continuity which will break down under some future current surge.

Where the connection between thin and normal wires is made mechanically, as by crimping at a connection point, the thin wire is sometimes partly broken by crimping pressure, leaving an inadequate connection.

None of these conditions is visible to ordinary inspection. When a wire is very fine to start with, the fact that it has become still finer at one point is not readily detected.

Still another cause for breakdown of very thin wires lies in their natural weakness under mechanical strain. When a coil is made of such wire, the end of the coil often is run to a connection point of the casing or frame in which the coil is mounted. Mechanical vibration that puts any tension on that thread of wire may ultimately result in breakdown.

In potentiometers, rheostats or adjustable pads, the fine wire of such windings will make contact with a normal-size conductor through the sliding contact as well as through the permanent connections. The best mechanical design and the most conscientious attention by projectionists will not always prevent the fine wire from tearing, sooner or later, as a result of friction with the sliding contact.

Whenever, therefore, an open circuit occurs in a line that includes fine-wire conductors, a time-saving procedure is to check those points at which the fine-wire and the normal-size conductors are joined together. There is a good probability that the trouble will be found there rather than at any other point in the same circuit.

In the case of a circuit including a potentiometer or similar device, check under the sliding contact. Sometimes a break in the very thin potentiometer coil may not be visible, but is instantly found by rubbing a finger lightly over the winding. In the case of phones, or of monitor or other speakers of inherently high-impedance construction, inspect the terminals of the magnet coils. If a speech transformer opens, the chances are good that the breakdown may not be within a coil—where it can't be reached—but at the point where the end of a coil makes contact with a connection point, and, therefore, easily repaired in the projection room. Similarly in meters, or in any other components using ultra-thin conductors—check first of all for breaks at the points of contact between thin and normal size wires.

If the apparatus has been impregnated a break may not be visible. The impregnating resin may make a pseudo connection. Test—very delicately—with a pencil point.

In repairing such breaks scrupulously avoid the slightest damage or corrosion to the thin wire—for example, even the tiniest knick in scraping off insulation. In crimping thin wire, or in clamping it under a nut or other termnal fastener, make sure pressure is evenly distributed over a fair length of the thin wire, not concentrated like a semi-knife edge that will eventually break through it. In soldering, use the minimum heat possible for a good connection, and *never* use anything but resin for flux.

In bringing out the end of any kind of a thin-wire coil to a terminal point to which it is to be connected, avoid pulling the thin wire taut. If vibration should cause the coil to move slightly with reference to the terminal point a very thin wire may snap unless it has a little slack.

MAURICE H. GOLDBERG

Maurice H. Goldberg, founder and president of GoldE Manufacturing Company, died on June 19. His many friends in the theatre field mourn his passing. The business will be carried on under the present management.

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IN THE SPOTLIGHT



By *HARRY SHERMAN*

THERE are many ways in which to skin a cat—our worthy congressmen found that out. Although the Little Steel formula is waved before labor whenever an attempt is made to obtain an increase for the workingman in line with the steadily rising costs of living, it took an act of Congress to show us how to get around that ruling. In voting itself an annual expense account of $2500, Congress completely ignored the Little Steel formula of pay stabilization. While the entire country is restricted to the 15% wage increase—that is, with the approval of the War Labor Board—the members of the House declared themselves to be beyond this restriction, and resorting to the "expense account" gag they boosted their salaries 25%. Nice work if you can get it, we say.

We believe that the members of Congress by their "irresponsible" act, as one leading newspaper called it, established a precedent for breaking the pay stabilization plan and pointed the way to circumvent it.

● Although George Clapp, member of Local No. 528, Kingston, Ont., Canada, has been a member of the I. A. only since 1941, he has gained since that time the respect and esteem of the local members to the extent where he was elected to the office of vice-president of the local.



George Clapp

Clapp served his apprenticeship at the Regent Theatre, in Picton, Ont., and when he received his license in 1930 he continued working there as projectionist for another eight years. In 1938 he accepted a position as projectionist in the newly erected New Grand Theatre in Kingston, Ont., a position he still holds. After many years of perseverance, Clapp realized his ambition and became a member of the I. A. in 1941.

● We finally got a nod of recognition from the managerial department. Irving Lesser, managing director of the Roxy Theatre in New York City and chairman of the War Activities Committee for the New York area in the 7th War Loan Drive, paid public tribute to the cooperation of the motion picture projectionists', stagehands' and musicians' unions in the drive.

"Too often," stated Lesser, "these behind-the-scenes men are obscured by the efforts and accomplishments of famous performing personalities and executives. It is obvious that without their services, always given freely and in the highest spirit of cooperation and patriotism, the industry would hardly be able to carry on its task of exceeding its quota in the present Seventh War Loan drive."

He particularly mentioned Projectionists Local No. 306; Westchester County Projectionists Local No. 650; Stagehand Locals Nos. 1 and 4 of Greater New York, and Musicians Local No. 802.

● Another projectionist lost his life in the line of duty. Robert Scott, projectionist employed at a local theatre in a small town in Oklahoma, was fatally burned when attempting to extinguish a fire caused by the ignition of film in the projection room. Scott, we understand, was alone in the projection room when the film caught on fire, and so rapidly did the flames spread that he received the fatal burns before the arrival of the firemen who put out the fire.

The projection equipment was undamaged—a fact that should make the theatre owner very happy for such equipment is hard to replace these days. A projectionist can be replaced more easily.

● Jimmy Ambrosio, treasurer of New York Local No. 306, considers himself a pretty lucky guy. His two sons, wounded overseas and hospitalized for some time, are now fully recovered and as chipper as ever. The older boy, a chief petty officer in the navy, had a rather harrowing experience. His ship was torpedoed seven times and he was rescued after floating in the water for nine hours. However, all's well that ends well.

● We received a visit last month from Morris Thacker, member of Chicago Local No. 110 and projectionist at the Lindy Theatre. Thacker was enjoying his first *vacation with pay* and spent much of his time in this city digging up information on television.

● William H. Maxon, member of Syracuse Local No. 376 for the past 25 years, has been bitten by the political bug and has announced his candidacy for public office in the fall elections. He has been endorsed by the Syracuse Fifth Ward Democratic Committee for the office of supervisor, and our grapevine tells us that he has an excellent chance of winning. Maxon is active in local affairs and has the backing and support of many prominent figures in civic activities. We are rooting for you, Bill, and hope you make the grade.

● Tom Murtha, popular Brooklyn Local No. 4 business agent and chairman of the Tenth District, resigned his position as president of the Central Trades and Labor Council of New York.

● The untiring efforts of the officials and members of Los Angeles Local No. 150 in their sponsorship of the "Ventilation Bill" were rewarded recently when Governor Warren of California signed the bill, thus making it a state law. Under this new law all new and renovated projection rooms must be provided with proper ventilation facilities before operation will be permitted. This is a step in the right direction and we hope that other I. A. local unions throughout the country will follow suit. Properly ventilated projection rooms will do much to lessen the dangers of many occupational ailments, such as tuberculosis, sinus, heart trouble, eye troubles, and other diseases to which the projectionist is exposed in his work.

● On learning of the recent death of Louis Pirovano, Local No. 182, Boston, Mass., our thoughts flew back to the I. A. 1944 St. Louis Convention. Louie was a

Local 182 delegate and on a number of occasions we both shared the same table and indulged in many a bit of pleasantry. It is hard to believe that he is no more.

Louis Pirovano was born in Italy in 1878 and came to this country when he was but a youngster. He made his home in Boston and became one of the best known and popular figures in theatrical circles in New England. He was a charter member of 182 and up to the time of his death was employed as projectionist at the Scollay Square Theatre in Boston—a position he held for about 25 years. He will be sorely missed by a host of friends he left behind.

● A letter from Gordon H. Dyer, member of Corpus Christi Local No. 604, now stationed "Somewhere in the Marianas," gives us a hint as to what we may expect when the war is won and our men return home. "There are hundreds of projectionists out here," writes Dyer, "and all I have talked to plan to enter the projection field after the war."

This merely echoes what we have been repeating month after month for the past few years. The majority of army and navy trained projectionists intend to continue with projection work when released from service. These ex-servicemen will demand that they be admitted to membership in the IA and be given jobs. And it is up to us, the men at home, to see that jobs are created for them.

We cannot stress too strongly the urgency for immediate action—a solution must be found to take care of this new influx into our craft, and the best solution, in our opinion, is that offered by Thad Barrows, president of Boston Local No. 182, in our September 1943 issue, and repeated May 1945 . . . "*In my opinion the first and most important step is the abolition of one-man operation in the projection room. This can be done if we agree to place in the projection room of every theatre now having a one-man shift a returned serviceman who will work on the job together with the regular projectionist. . . .*" (A copy of the complete article as it appeared in the September 1943 issue will be sent to any union official upon request.)

● A new "labor relations" bill (officially known as S. B. 1171) introduced by Senators Hatch of New Mexico, Burton of Ohio, and Ball of Minnesota, is the latest threat to organized labor. The measure, which calls for compulsory arbitration in certain disputes, threatens the closed shop, and establishes government regimentation of labor, has been strongly denounced by labor leaders throughout the country and has been termed by AFL President William Green as a "straightjacket for labor."

"Three senators, without practical experience in the field of labor relations, have hit upon a design for the future, tailored a straightjacket for labor and are now seeking to compel the nation's workers by law to wear their creation," declared President Green. He further stated that although Senators Hatch, Burton and Ball said that this bill had been 18 months in preparation, it was significant that labor was never consulted about its provisions and never saw a copy of it until it was introduced.

This bill should not be dismissed lightly, and we urge our readers to bombard their congressmen with demands to vote against it. Should such a measure be passed, all of organized labor's long established and recognized rights will be endangered.

● We are glad to welcome back to our midst Allen J. Smith, former chief of the Theatre Equipment Section of the WPB, who has resumed his duties as district manager for the National Theatre Supply Company. Smith, a former member of Local No. 249, Dallas, Texas and an honorary member of the 25-30 Club, enjoys the friendship of many IA men throughout the country.

● It is heartening to note that religious leaders in many parts of this country are taking an ever increasing interest in the problems that will confront labor in the postwar days. In an address before the Social Science Forum, Siena College, Loudonville, N. Y., the Most Rev. Bernard J. Sheil, senior auxiliary bishop of Chicago, eloquently expressed his views on the need for greater cooperation between labor and management in the days to come.

"For the building of a world a man can live in," stated Bishop Sheil, "I strongly urge that labor unions extend their activities beyond a mere definition of wages and hours and the settlement of isolate grievances. These are the minimum actions of any labor union.

"I submit that all labor unions must participate in the management of industry. This is not a bid for anarchy; but a bid for that form of partnership which would permit a graduated share in the ownership and profits of business and also some voice in its management. Surely this is not an excessive demand on the part of labor. It is not a question of labor taking over management lock, stock, and barrel. It is simply the workers' request that they should have a voice in things that affect them vitally."

● Through Orin M. Jacobson, IA International Representative, we learned that Seattle Local No. 15 presented Charlie Crickmore with a gold life membership card as a reward for many years of faithful and loyal services rendered the local.

● We received a very nice letter of appreciation from George E. Thrift, recently elected secretary for Local 348, Vancouver, Canada, in behalf of the

(*Continued on page* 29)



Chicago Local No. 110 hits the bull's-eye in the 7th War Loan Drive. Although the local set its goal as $300,000 for the purchase of war bonds, this sum was exceeded by several thousand dollars. James J. Gorman, president of the local is shown presenting a check for $303,550 to U. S. Treasury aide, R. P. Sherer for bonds purchased by Local 110 members. George T. Moore, (next to Gorman) head of Treasury's labor division in Chicago and Gene Atkinson, progressive business manager for the local, (extreme right) look on approvingly.

Projectionists' Course on Basic Radio and Television

By *M. BERINSKY, E. E.*
MEMBER OF INSTITUTE OF RADIO ENGINEERS

XIII—INDUCTANCE

A RADIO, whether it be a 5-tube a.c., d.c. midget, or a 20-tube television set, consists of a combination of four basic components; namely, resistance, inductance, capacitance, and vacuum tubes.

The radio signal which we desire to hear or see (television) is an alternating current. Although a radio also has direct currents present in most of its component parts it can be seen that the action of the alternating currents upon these parts is of prime importance.

A resistor behaves in a like manner to alternating and direct currents. This only holds true over the ordinary range of alternating currents and does not apply to very high or even to high frequency alternating currents. There is a radical difference in the reaction of inductance and capacitance to alternating and direct currents.

Inductance

Whenever a wire is wound in the form of a coil a radio part is created. This coil is known by several names, such as coil, choke, and inductor. In order to get a clearer understanding of the term "inductance," we must go back to the installment relating to electromagnets.

You will recall that an electromagnet consists of a coil of wire with an air or an iron core, connected to a source of direct current. The instant that the switch is closed the lines of force around the coil commence to build up and in a very short time the magnetic flux reaches a maximum value. After this maximum value of flux is reached, it remains constant until the switch is opened. When the switch is opened, the lines of magnetic flux decrease in number as a function of time, until zero flux remains.

The lines of flux do not reach a maximum value at the very instant that the coil is connected to the battery, nor do they reach a minimum at the very instant that the switch is opened. The lines of force (flux) around the coil depend upon the amount of current through the coil. Since the lines of force around the coil take some time to reach a maximum or a minimum value it follows that the current through the coil also takes a certain amount of time to reach a maximum or a minimum.

When a battery is connected across a coil, the full voltage of the battery is immediately applied to the coil. The final maximum value of current through the coil, however, appears a little later. It can be said, therefore, that in a coil the current lags behind the voltage.

A coil resists any change in the amount of flux passing through it. Since the flux is dependent upon the current in the coil, it follows that a coil will also resist any change in the amount of current flowing through it. Let us see why a coil will resist a change in current.

When a coil is connected to a battery a current begins to flow through it. Lines of force will commence to build up around the coil. Since these lines of force are moving, that is, building up from zero to some maximum value, they will cut the wire which forms the coil.

By Lenz's Law a back e.m.f. (electro motive force) will be induced in the coil which will tend to oppose the force causing it. The force causing this back e.m.f. is the battery voltage which is impressed across the coil. If the battery is trying to send current through the coil in some particular direction, the back e.m.f. will oppose or try to buck out this current. Eventually the lines of force will reach a maximum value and will remain constant. Since they no longer will change in intensity they will not be capable of creating a back e.m.f. so the current through the coil will reach its final Ohm's Law value. That is, I (the current through the coil) will equal E (the voltage across the coil) divided by R (the resistance of the coil).

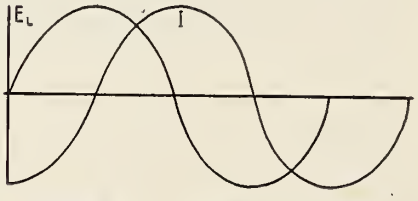


FIGURE 1. *E leads I by 90°.*

The action taking place within a coil which prevents the current running through it from reaching a final value at the instant that the switch connecting it to the battery is closed, is known as the coil's inductance. This inductance is relatively unimportant when a coil is connected to a source of direct current such as a battery, because its action exists only when the switch is opened or closed.

Units of Inductance

The inductance of a coil is dependent upon the number of turns, the mean diameter of the winding and the axial length of the winding. The unit of inductance which is an indication of the size of the coil, is called the "henry." This unit is similar to the ohm which gives an indication as to the size of a resistor. In radio, the henry usually is too large a unit for practical work. For this reason, smaller units are also widely used—the microhenry (one millionth of a henry), and the millihenry (one thousandth of a henry).

The henry is defined as the amount of inductance necessary to create a back e.m.f. of one volt in a coil when its current is changing at the rate of one ampere per second. A coil that contains a large number of henrys will prevent the current through it from reaching its final "Ohm's Law" value for a longer period of time than a coil which has a smaller inductance.

We say that a large coil has a larger time constant than a smaller coil, the time constant being an indication as to the amount of time taken for the current to build up within a coil. Numerically the time constant is given by the following formula where T. C. is the time

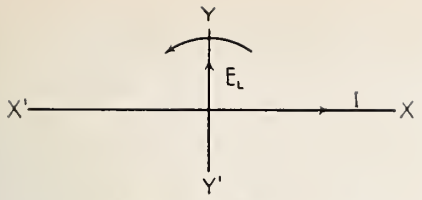


FIGURE 2. ***E leads I by 90°.***

constant in seconds, L is the inductance of the coil in henrys, and R is the resistance of the coil in ohms:

$$\text{T.C.} = \frac{L}{R}.$$

We will now illustrate the use of this formula with a typical example. Find the time constant of a 10 henry coil with a resistance of 100 ohms. The formula for this example is:

$$\text{T.C.} = \frac{L}{R} = \frac{10}{100} = 0.1 \text{ seconds.}$$

Although inductance is not of great importance when found in direct current circuits, it holds equal importance in alternating current circuits with resistance or capacitance. In direct current circuits the effects of inductance are only in evidence when the switch is opened or closed because at such a time the current through the coil is changing. After a short period of time the current will reach a steady value and the coil will act like an electromagnet.

In alternating current circuits the line voltage which is impressed across the coil is undergoing a continual change in intensity. It starts at zero and rises until it reaches a maximum value in one direction, then returns to zero, rises to a maximum value in the opposite direction and again returns to zero. Since the voltage is always varying in its amplitude, the current through the coil will never be able to reach its Ohm's Law value since this is possible only when the source voltage is a steady direct current. The back e.m.f. within the coil will always be present and will always try to prevent the current through the coil from changing in value.

When the switch is closed the full voltage of the source immediately is connected across the coil. The current, however, is kept out to some extent by the back e.m.f. The full voltage, therefore, appears first, followed later by the current. We say that in a coil the voltage leads the current by 90°, or what is the same, the current lags the voltage by 90°. Figure 1 shows this condition graphically.

When two sine waves are shown graphically, the one which is leading is the one which has its positive peak first. The sine wave labeled "E" is seen to have its positive peak before the sine wave labeled "I". This is not the only way in which the relationship between voltages and currents, known as phase relations, can be represented.

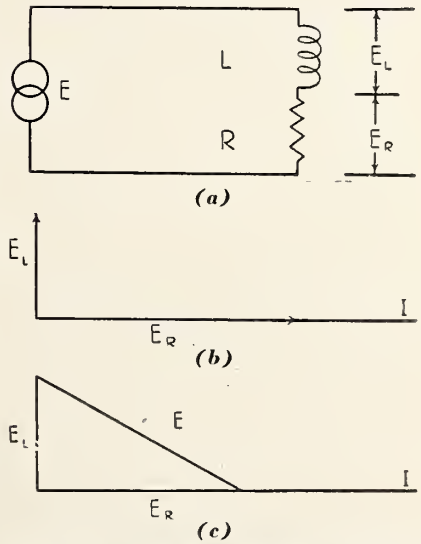
Another method of indicating the phase relations between voltages and currents is illustrated in Figure 2. In Figure 2, E_L, the voltage across the coil, is seen to point in a vertical direction and I in a horizontal direction. This is known as the vector method for indicating phase relations, and is preferred to the sine wave method when several voltages and currents are to be shown on one graph. The current, I, is laid off as a horizontal line. This line is known as the terminal or reference line.

These vectors are assumed to be rotating in a counter clockwise direction, as is indicated by the curved arrow. Since the assumed direction of rotation is counter-clockwise, the vector that is moving out in front in this direction is said to be leading the other. Vector E_L is seen to be out in front of vector I and is, therefore, leading I. The angle between E_L and I is seen to be equal to 90°, so the diagram shows that E_L is leading I by 90°. Anything above the Xs would be leading I, but if anything were drawn below the X line it would be lagging I.

Inductive Reactance

A coil which contains only inductance and no resistance is known as a pure inductance. Such a coil is, of course, imaginary. It is impossible to construct a coil without resistance because coils are wound with wire, and wire contains a certain amount of resistance. When discussing radio theory it is sometimes convenient to speak of pure inductance.

FIGURE 3



(Top) 3a. Coil and resistor connected in series and the voltage drops which result.
(Center) 3b. Vector diagram for Figure 3a.
(Bottom) 3c. The line voltage E is the vector sum of E_L and E_R.

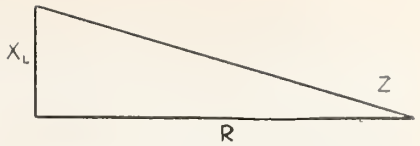


FIGURE 4. ***Impedance triangle.***

In Figure 1 the voltage is seen to lead the current by an angle of 90°. This condition holds true only for pure inductance. In a practical case the voltage leads the current by some angle which is less than the 90° shown, because of the effects of the resistance in the coil.

We have seen that a coil offers a certain amount of opposition to a change in the current running through it. When alternating current is flowing through the coil this opposition is especially effective. It should be remembered that this opposition is due to the fact that a back e.m.f. is induced in the coil when the current through it is changing, and has nothing to do with the direct current resistance which the coil may have. Because this is a special type of resistance it has been given a special name. The opposition that a pure inductance offers to the flow of an alternating current is called "inductive reactance." The electrical symbol for inductive reactance is X_L, which is read X sub 1. This reactance is measured in ohms the same as resistance but its effects in a circuit are somewhat different.

The inductive reactance is dependent upon the inductance of the coil and the frequency of the applied voltage. The formula for inductive reactance is $X_L = 2 \pi f L$. Where π (pi) is a constant which is equal to 3.14, f is the frequency of the applied voltage in cycles per second, and L is the inductance of the coil in henrys. An example showing a practical application will now be given.

Suppose that a 10 henry choke is connected across 110 volts, 60 cycles, a.c. Find the reactance of the coil.

(*Solution*) $X_L = 2 \pi f L = 2 \times 3.14 \times 60 \times 10 = 3768$ ohms.

Since reactance is a form of resistance it is possible to use it in Ohm's Law formulas. I, the current through the coil may be found by dividing the line voltage E by the inductive reactance X_L. To illustrate, let us find the current that will flow through the coil. $I = E/X_L = 110/3768 = 0.029$ amperes.

The examples thus cited have concerned only coils having pure inductance. In practice coils contain a certain amount of resistance as well as inductance.

Whenever an alternating current flows through a resistor the current will be in phase with the voltage. If a coil which contains resistance is taken under consideration, it will be found that the

Presenting: Frances Perkins



FRANCES PERKINS, who recently resigned as Secretary of Labor of the United States, has an outstanding record as a friend of labor and for that reason is being honored this month by I.P., commemorating her long service in the interest of the working classes.

She was born in Boston, Mass., on April 10, 1882, educated in private and public schools in that State, and was graduated from Mount Holyoke College. She studied as a post-graduate student at the University of Chicago, University of Pennsylvania, and Columbia University, specializing in sociology and economics. She was married to Paul Wilson in New York City on Sept. 26, 1913.

Previous to her appointment as Secretary of Labor in March, 1933, by President Roosevelt she was Industrial Commissioner, New York State Department of Labor, 1929-1933.

Upon leaving the U. S. Department of Labor Miss Perkins was presented with a scroll by department officials, upon which were outlined measures "that have been adopted largely as a result of your initiative and leadership."

In 1910 she became executive secretary of the Consumers' League of New York City, in which position she made and directed investigations of factories, mercantile establishments, tenement home-work manufacture, bakeries, laundries, etc.

Acting as a representative of the Consumers' League, and in charge of their legislation, she conducted a successful campaign for the passage of what is commonly known as the Fifty-Four Hour Bill, namely, the law which limits the hours of labor of women in mercantile establishments to fifty-four hours a week or nine hours a day in the State of New York. This bill became a law in the spring of 1912. During this period she also urged successfully amendments to the Labor Law in regard to the protection of women and minors and the regulation of tenement home-work manufacture.

In 1911 she conducted an investigation into cellar bakeries in the City of New York, in cooperation with the Commissioner of Accounts, and published jointly with him the results, which led to a thoroughgoing regulation of the sanitary conditions in cellar bakeries by the city authorities.

In 1912 she became secretary of the Committee on Safety, an organization of private citizens formed after the Triangle Fire, to promote various measures designed to prevent factory catastrophies, either from fire or other accidents.

Representing the Committee on Safety, she cooperated with the Factory Investigating Commission in drafting the new provisions of the Labor Law particularly those relating to the prevention of life hazards from fire and accidents. Acting as a representative of the Committee on Safety, she also urged the passage of these new Labor Laws before the public and the Legislators.

As Industrial Commissioner of the State of New York she was directing head of the New York State Department of Labor and also engaged in writing, public speaking, and legislative work. During the four years (1929-1933) she gave much attention to the problem of unemployment, issuing a monthly statement on employment trends in 1,800 New York State factories, which was accepted as an authoritative index to business conditions in the State. As ex-officio member of Governor Roosevelt's Commission on Unemployment Problems for the State of New York, she assisted in devising and promulgating plans for industrial stability and social insurance.

During her administration as Indus-

(*Continued on page* 30)

JUNE QUESTIONS AND CORRECT ANSWERS

1. **(Q) Find the effective value of a peak voltage of 1,000 volts.**
   (A) 707 volts.
2. **(Q) Find the peak value of an effective value of 120 volts.**
   (A) 169 volts.
3. **(Q) In a right triangle the angle A is 30 degrees and the side (c) is 100 volts. Find the voltage of side (a).**
   (A) 50 volts.
4. **(Q) Find the voltage of side (b).**
   (A) 86.6 volts.

voltage drops divide—a part of the total voltage appearing across the pure inductance and a portion of the total voltage appearing across the resistance. These voltages are not in phase with each other. This leads to an explanation of alternating current circuits that is quite different from that of direct current theory.

In a direct current series circuit the sum of the voltage drops is equal to the total voltage. This is not true in an alternating current series circuit which contains inductance and resistance because the voltage drops across the coil and the resistor are 90° out of phase with each other.

The connections for such a circuit are shown in Figure 3a. Figure 3b shows that the voltage across the resistor is in phase with the current, but the voltage across the coil leads the current by 90°. The voltage across the coil is also seen to lead the voltage across the resistor. In Figure 3c we see that the line voltage E is not equal to the algebraic sum of E_L and E_R, but is, instead, the vector sum of the two. This means that the line voltage is equal to the square root of the sum of the squares of the voltage across the coil and the voltage across the resistor.

Reactance and resistance may also be shown in the form of a vector diagram although technically speaking they are not vector quantities. Figure 4 shows how X_L and R are laid off on a vector diagram. When resistance and reactance are connected in series a new quantity called impedance is introduced. Impedance is the resultant of resistance and reactance and is measured in ohms. It is a very useful quantity and appears frequently in alternating current work.

Let us now work a problem showing how impedance is calculated. Suppose that an inductive reactance of 8 ohms is connected in series with a resistance of 6 ohms, and the problem is to find the value of impedance in the circuit. The formula for the impedance (Z) is, $Z = \sqrt{R^2 + X^2}$.

The little number (2) means that the quantity under it should be multiplied by itself. After R and X have been squared the results should be added and then the square root of the sum should be taken.

(*Solution*) $Z = \sqrt{6^2 + 8^2} = \sqrt{36 + 64} = \sqrt{100} = 10$ ohms.

JULY QUESTIONS

1. **Find the reactance of a 2-henry choke connected across 100 volts, 60 cycles.**
2. **Find the current that will flow through the coil.**
3. **Find the reactance of a 50 microhenry coil connected across one volt at 200 kilocycles. (Hint: Convert 50 microhenrys into henrys and 200 kilocycles into cycles.)**
4. **A reactance of 3 ohms and a 5-ohm resistor are connected in series. Find the impedance.**

The correct answers to these questions will appear in the next issue.

AT YOUR SERVICE

This department is a collection of random thoughts and some not so random: fact, fancy and opinion relating to the man behind the man behind the gun—the serviceman. The prime purpose of this section is to promote a closer relationship between serviceman and projectionist based on a better understanding of their mutual problems through an exchange of news and views, kinks and kicks. To this end, contributions relative to any phase of the serviceman's activities are invited.

Checking WE 86-Type Amplifier

Readings quickly taken between the 86-type amplifier meter plus terminal and ground can be periodically compared to indicate roughly the condition of the seven electrolytic capacitors by looking for lowered resistance across each paralleled circuit; also to isolate open portion of bleeder resistor R-46 (40,000 ohms). Suggested method of checking is given below.

1. *Open primary switch.*
2. *Hang the meter panel so that the wires do not ground on the frame.*
3. *Set the Weston 772 analyzer on Rx 10,000 scale.*
4. *Clip the Weston 772 analyzer minus prod (batt. +) to meter plus terminal.*
5. *Clip the Weston 772 analyzer plus prod to ground.*

Read dialed positions 1, 2, 3 and 4. Read 250 ohms between position 4 and rectifier filament pin. Change clip to meter minus and read at No. 7 or No. 6 for 716 or 714 filter to ground. Five plate load d.c. values may be read by dialing prod between meter minus and correct tube pin. Hot amplifier voltages taken from meter to ground offer a useful check where panel meter voltages are not properly or positively indicated because of improper switch wipings.

The above checks should be used for purposes of comparison only.—R. L. Brierly, *RCA.*

Longer Life from Lamphouse Reflectors

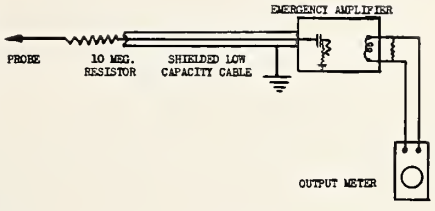
It seems to be an established custom among many projectionists to rotate lamphouse reflectors from time to time. The habit probably originated as a means of distributing the pitting evenly over the surface of the reflector, thereby preventing extreme pitting of the lower portion only.

Such a practice not only reduces the effective brightness, but may cause physical injury to the mirror. Since the reflected light from the bottom of the mirror is obstructed by the carbon standard, pitting of the lower mirror area will not affect the light appreciably. Also, in many instances, the silvering is scraped off the back of the reflector by the mirror pressure springs when it is rotated.

In speaking of scratching, I quote in part from a booklet printed by a manufacturer of reflectors: "The question of scratching is of paramount importance to projectionists, as carbon particles and other foreign matter are sure to work into the cleaning process of any projection reflector. Representative tests have been made to determine the percentage of loss suffered in this manner. A new reflector was given a photometric recording through a standard projection system, removed and secured with sand until the entire surface was covered with scratches. This extreme test produced a loss of reflectivity of only 4 per cent, which leads to the conclusion that average scratching, even over an extended period of years from normal cleaning, would result in a negligible light loss." —W. Hilliard, *ALTEC.*

Shooting Trouble With an Emergency Amplifier

In shooting trouble in low level amplifier stages, it has been found that the emergency amplifier and an output meter may serve as an excellent device for



measuring gain per stage. A length of low capacity cable is used as a test lead with a ten meg. resistor on the probe end (see figure above). The test lead is attached to the emergency amplifier input through a blocking condenser. An advantage of this "Goldberg" is that the gain is read directly in decibels.—F. M. Walls, *RCA.*

Servicing 16-mm Equipment

Here are a few timely tips on the servicing of 16-mm equipment.

1. When the lower tooth on a three-claw shuttle is undercut, hone is flush with the undercut surface, thereby distributing the film "pull-down" load to the other teeth.

2. That 120-cycle hum—assuming the exciter lamp operates from an oscillator supply—most of it comes from modulation of the oscillator, due to poor power supply filtering. To test it block off the sound light with cardboard when the amplifier volume is on full. If the hum drops, then it is in the exciter lamp supply. Remedy: better filtering of "B" supply. This requirement for humless operation is much more critical for the oscillator supply to the exciter lamp than the rest of the amplifier. (Any old-time radio ham can tell you that.)

3. If your projector runs "red-hot," check the blower. Sometimes the blower may be reversed sidewise, and thus inhale instead of exhale.

4. Microphonics—Always suspect those 6 v, 1 amp. exciter lamps before condemning the tubes. For a quick check, block off the light and listen (volume on full). Analysis is obvious. Those PEC's used in 16-mm are also very temperamental; pull the cell and listen before you remove the rear axle.

5. Focusing the sound optical without special tools is difficult, due to jump in moving the lens by hand. I suggest that you remove the optical and rub the barrel with paraffin or beeswax, which will act as a brake and permit better setting of focus and azimuth.

6. 16-mm acetate base film is far more susceptible to humidity and temperature changes than nitrate stock. In some cases it is so severe that projector service is attempted to cure the in-and-out of focus effects. Keep 16-mm film in a dry place and do not subject it to cold. In a case of this variable focus effect, try some known good film as a check before you alter gate adjustments.—L. P. Work. *JAM HANDY.*

Oil Stoppage in Oil Cups

The cap on the oil cup SN-190 of the SH-2008 stub in the Simplex soundhead, or any other piece of equipment, usually is so closely fitted that unless it is sprung slightly to let in a little air, the oil will not flow and, consequently, the drive gear will run hot.

Since the same type oil cup is used on various projectors, especially shutter shaft assemblies (the highest speed shaft in a mechanism), similar trouble will be avoided by following this procedure.—W. W. Wehr, *ALTEC.*

Du Mont's Projection Tele†

In this article a model with refracting lens system for pictures up to 4x6 feet and direct-view set with 20-in. tube is revealed.

MOST recent among public demonstrations of television receivers for post-war production, is the DuMont projection system based on refractive optics. Here a regular lens is used in place of the Schmidt mirror reflective optics as described in the April issue of *Electronic Industries* relative to the RCA projection receiver.

The Allen B. DuMont Laboratories recently demonstrated two forms of receivers, in operation from their television station WABD, New York, one, equipped with a 20 in. diameter screen for direct viewing of the received pictures, and the other a projection model designed for the home and also for use in public gathering places.

More spectacular in its demonstration and possibilities is the projection unit which produces pictures 3 by 4 ft., and up to 4½ by 6 ft. in size. This unit has a 7 in. diameter cathode ray tube operating at 28,000 volts on the second anode, and a conventional projection lens system to project the image onto a special screen. In the demonstration, a sufficiently brilliant image for an audience of nearly 100 people was produced with this equipment. The focus and definition were quite good.

The brilliance of the picture is enhanced by the design of the viewing screen. This viewing screen is not a flat surface, but is very slightly curved in the horizontal plane (concave toward the viewing audience). The screen has a reflection power similar to the glass beaded screen used in motion picture work.

The combination of the reflective properties of this screen, in addition to its concavity, makes it possible to view pictures from almost any angle without serious distortion. The brilliance of the screen drops off as the angle of viewing the screen increases. Measurements show a screen illumination of about four footcandles.

The cross section of this projection unit is shown in Figure 1. The lens system is 3½ in. in diameter and has a speed of f/1.5. The focal length is 144 mm.

This lens system can be of relatively inexpensive construction at least for black and white pictures, when produced in mass quantity. The DuMont Laboratories report that a number of simple and inexpensive lenses have been tried with this projection equipment and that the results are satisfactory.

The 7 in. projection tube used in this unit has a flat screen face. The actual image on the tube is approximately 4 x 5 in. Magnetic deflection and magnetic focusing are used.

A feature of this particular form of television projection is that the color system in which a rotating color filter wheel is used can be rather easily adapted to it. It is a fairly simple matter to interpose a color wheel in front of the rather small cathode ray tube for the purpose of producing the three primary color images which are then enlarged by the lens system. Such a color filter wheel cannot be easily interposed between the tube and the spherical mirror employed in the Schmidt projection system as they are presently mounted in proposed home projection receivers.

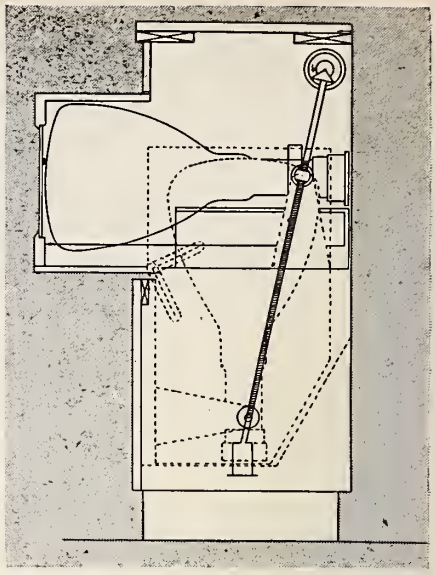


FIGURE 2. ***Mechanism for moving 20 in. tube into position.***

However, the color system can be used with the Schmidt projector provided the projection tube is mounted back of the spherical mirror and a suitable reflecting surface is placed where the screen of the cathode ray tube would normally be. In this way, a color wheel can be placed between the screen of the cathode ray tube and the hole which is cut through the bottom of the spherical mirror and suitable color projection obtained.

The DuMont projection unit produces a picture with a magnification of 9:1. The demonstration was made with the video signal from the studio being wired directly to the projection unit. No radio circuit was involved. At a viewing dis-

† *Electronic Industries, June* 1945.

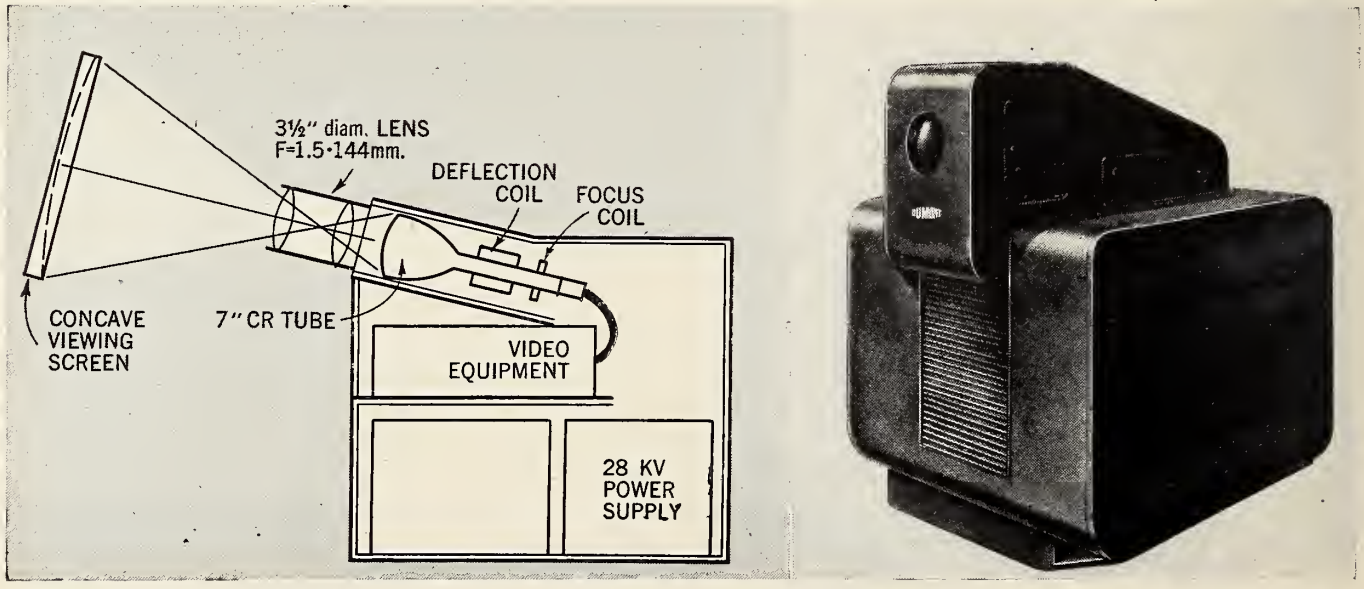


FIGURE 1. ***Cross section and working model of television receiver. The image is projected on concave viewing screen by lens system.***

ALLEN G. SMITH REJOINS N.T.S.

Allen G. Smith, formerly chief of the Theatre Equipment Section of the War Production Board, has rejoined National Theatre Supply, according to an announcement by Walter E. Green, president. Before he was called to Washington in 1942 Mr. Smith represented NTS in the Southwest territories, and has been associated with the company since 1926.

In addition to looking after National's interests in Washington, Mr. Smith will be of assistance to those subsidiaries of General Precision Equipment Corporation, which manufacture theatre equipment and supplies. These include Strong Electric Corp., Toledo, and J. E. McAuley Manufacturing Co., Chicago, manufacturers of projection lamps, and Hertner Electric Co., Cleveland, manufacturer of motor generators.

Mr. Smith also will make himself available to WPB as a consultant on problems affecting the industry as a whole.

RCA VICTOR BUYS BRENKERT

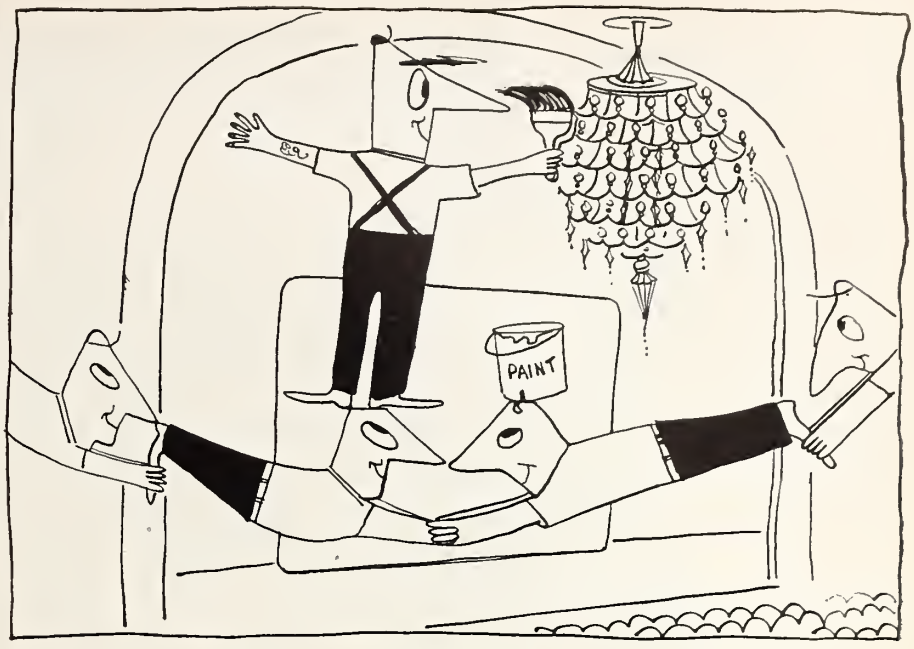
Frank M. Folsom, executive vice president of the Radio Corp. of America in charge of the RCA Victor Division, announces purchase of the Brenkert Light Projection Co., and plans for expansion of its production facilities to meet increasing demands for Brenkert motion picture projectors and arc lamps and accessories.

The Brenkert company, located in Detroit, will continue to operate as a separate company under its existing name, and Karl and Wayne Brenkert will remain active in its management. RCA Victor has been exclusive distributor of Brenkert products since 1941.

tance of approximately 8 ft., no line structure was visible. The standard 525-line transmission was used. Focus over the entire area was good and the illumination was uniform. This projection unit is designed both as a home unit and as a commercial unit for schools, clubs, hospitals, small theatres, etc. The latter is planned to sell as a unit for approximately $1,800.

The second model is based on the direct viewing principle in which a 20 in. diameter cathode ray tube is used to produce a 13½ by 18 in. picture. The principal feature of this equipment is the arrangement to reduce the depth of the cabinet necessary for such a large tube. The 20 in. diameter tube, which is approximately 32 in. long, is mounted on a framework within the cabinet and so arranged that the tube and frame may be tilted about a front pivot point and the tube lowered into a vertical position when the cabinet is closed and not in use.

This arrangement and the necessary electrically operated mechanism for moving the tube is shown in Figure 2. The lifting mechanism is entirely automatic and is operated by a push-button on the receiver panel. The use of this arrangement allows the cabinet depth to be held to 24 in. The tube and its housing project approximately 10 in. beyond the front of the cabinet when the set is in operation.



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ANALYSIS 16-MM AMPLIFIER

(*Continued from page* 10)

speech or fluctuating voltage drop through those two series resistors—but not, because of the coupling condenser, across their d.c. voltage drop. The fluctuations, being an a.c. component, can get through the blocking condenser, the d.c. cannot.

The right-hand section of tube No. 3, like any amplifying tube is a variable-resistance device, and its resistance (internal resistance of the tube) is controlled by the speech voltage applied to the control grid. When the applied signal causes the grid to become less negative, the effect is to lower the internal resistance of the tube, allowing the plate current to increase. When the grid becomes more negative, the internal resistance goes up, and plate current declines.

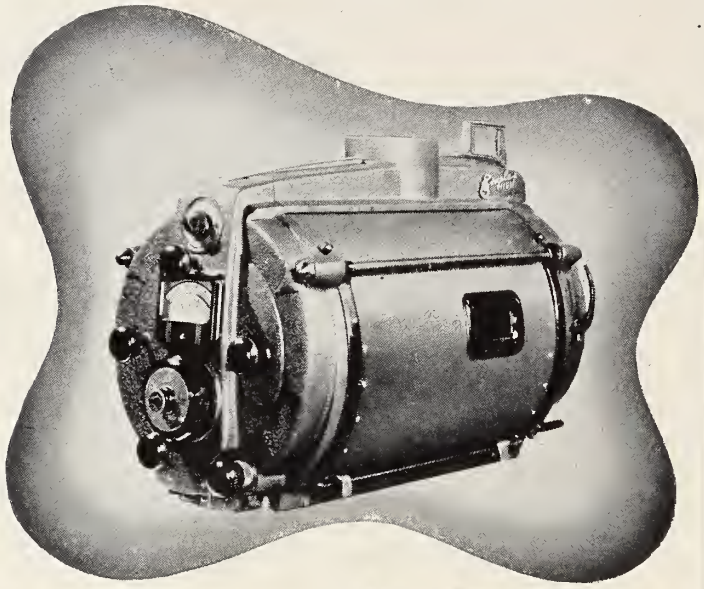
The plate supply to the right-hand section of tube No. 3, as already traced, comes through resistor *A* 598 (drawn just below the plate) 100,000 ohms. That resistor is not a variable resistance gadget; its change is fixed and permanent. When plate current increases the voltage drop through *A* 598 increases, according to Ohm's Law. Therefore, more of the total voltage drop available is consumed in *A* 598, and the voltage drop between plate and ground declines accordingly. That is, the voltage drop across the tube itself declines. This takes place when the current across the tube goes up.

In other words, because of the variable resistance inherent in an amplifying tube, the plate voltage behaves adversely to the plate current—voltage increases when current declines and vice versa. This is not a violation of Ohm's Law. It results from the variations in tube internal resistance, which in turn result from those variations in grid charge produced by the input signal. That is why the tube amplifies.

Now the resistors, *A* 292-*A* 598, drawn above the cathode, are also in series with the tube, and they, like the plate resistor *A* 598, are fixed resistance devices. When plate current increases the voltage drop across those two resistors increases also, as Ohm's Law requires.

Hence, when the current through the right-hand section of tube No. 3 increases, the plate voltage with respect to ground decreases, but the cathode voltage with respect to ground (92 volts) increases. And vice versa when tube current declines. Plate and cathode, consequently, can be made sources of a push-pull speech voltage, which can be applied to the grids of a push-pull stage. We have seen that the grids of tube No. 4 and tube No. 5, the push-pull stage, are connected (through coupling condensers) to plate and cathode of the right-hand side of tube No. 3. The cathodes of the push-pull stage do not go directly or through condensers to the cathode of the right-hand half of tube No. 3, but to ground.

Push-pull input requires not only voltage fluctuations of opposite phase, but also of equal intensity. It may be noted on the drawing that in the right-hand section of tube No. 3 plate voltage to ground is 220, cathode voltage to ground only 92.



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These voltages are not equal. But they are d.c. voltages. The extent of the fluctuations in voltage is what counts: those fluctuations must be equal as well as opposite. This condition is obtained by correctly proportioning the values of the cathode resistors, *A* 292-*A* 598 to the average internal resistance of the tube. Equal and opposite voltage fluctuations, or speech a.c., are therefore applied through the coupling condensers between grid and cathode of the push-pull team.

Feedback Lines

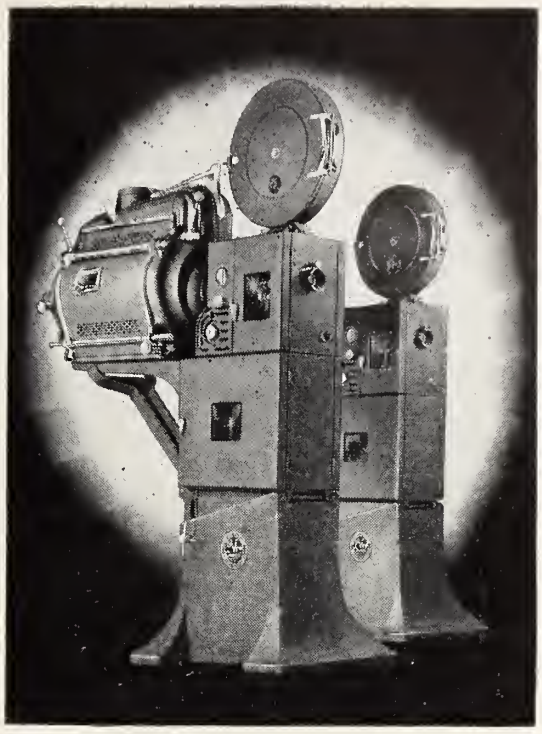
Plate and cathode of tube No. 4 may be regarded as source terminals of an amplified supply of speech a.c., with the upper half of the primary of the output transformer as the load. From plate trace right to the transformer, down to the center tap, right and down to the top of *A* 1700, left to the next junction and up through 16 mfd to ground. From ground back to the cathode of the tube through 50 mfds as before.

Tube No. 5 similarly supplies speech a.c. (180 degrees out of phase with that from tube No. 4) to the lower half of the output transformer primary.

From the bottom of the output transformer secondary trace straight down to the ground bus. From the upper end of that secondary trace right and down to the right side of the lower (16 ohm) speaker output terminal; and from the other side of that terminal left and up to ground. From the center tap of the output secondary trace similarly to the upper (8 ohm) speaker terminal, and thence to ground as before.

Note that while each half of the output transformer secondary is of 8 ohms impedance, the drawing shows each to be of .37 ohms d.c. resistance. The d.c. resistance is similarly shown with reference to the primary windings of that transformer, and with reference to the power transformer windings and to the oscillator tube coils. This information is included for guidance in making ohmmeter checks. Since the ohmmeter works with d.c., it, of course, reads only d.c. resistance.

From the upper end of the output transformer secondary trace down to the first junction, left through *A* 210, left past *A* 1565, up through *A* 71 and right to the positive side of *A* 119, the cathode resistor of the left-hand side of tube No. 3. Since the negative side of that resistor is grounded, and since the lower end of the output transformer secondary is also grounded, speech output is thus directly connected across this cathode resistor, which provides grid bias for the left-hand side of tube No. 3. The speech output thus coupled back in inverse phase is reduced in voltage by the series resistors *A* 210 and *A* 71, and by the bleeder resistor, *A* 1565.



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New NFPA Code Recognizes Need for Two Exits to Projection Room

By *HENRY B. SELLWOOD*

Need for two exits to the projection room, a point I.P.'s Harry Sherman has long been stressing, is recognized in the 1945 fire code for nitrocellulose film, issued by the National Fire Protection Association. Excerpts from the code, which very possibly will become official for the postwar projection room, are given here, and compared with Underwriters' requirements previously printed by I.P. The new code is also seen to contrast favorably, from the point of view of the projectionist, with a 1941 publication of the NFPA, indicating progress of a kind that every member of the craft will welcome.

RECOGNITION of the need for two exits to a projection room distinguish the latest edition of the National Fire Code, just issued by the National Fire Protection Association. The new code represents a distinct advance, from the point of view of the projectionist, over previous standards set up by the Association.

For example: in the matter of two exits to the projection room, a previous NFPA publication stated flatly: "Openings in the booth should be limited to a small entrance door and necessary operating openings." But the current edition of the code has a very different prescription: "*The entrance door into the enclosure shall be at least 2 feet by 5 feet. . . . For new construction it is recommended that at least two doors be provided, each not less than 30 inches wide and 6 feet high.*"

The first of the two quotations given above—the one limiting the "booth" to one small entrance door—is taken from The Handbook of Fire Protection, 1941 edition, published by the National Fire Protection Association of Boston, edited by Robert S. Moulton, technical secretary of the NFPA, page 312. The second quotation, calling for two substantial-sized exits, is from the National Fire Codes, Volume I, 1945 edition, also published by the National Fire Protection

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Association of Boston, and edited by Robert S. Moulton, technical secretary, page 389.

Other interesting departures from the 1941 "Handbook" are found in the 1945 "Code." Although the Handbook gives a much smaller amount of space to the question of projection room fire protection, it had room for talk of "carelessness" in the handling of film (page 312). The 1945 Code, devoting far more space to the same subject, goes into considerable detail as to how film ought to be handled for maximum safety, but search of it reveals no references to "carelessness".

The new code is not completely without unconscious humor, however. Here is the rule it lays down for behavior of the projectionist in case of an aperture fire: "In the event of film fire in a projector . . . the projectionist should immediately shut down the projection machine and arc lamps, operate the shutter release at the nearest point to him, turn on the auditorium lights, leave the projection room, and notify the manager of the theatre or building." What the manager is supposed to do about it is not explained.

Underwriters and NFPA

I.P. reprinted, in the February 1944 issue, a portion of the Underwriters' regulations covering the handling of motion picture film. The National Fire Protection Association is not the same body as the National Board of Fire Underwriters. The two codes nevertheless are very similar, sometimes following each other word for word. Sometimes slightly different words are used to convey the identical meaning: "fireproof" as used by the Underwriters means exactly the same things as "fire-resistive" used by the NFPA. Since the Underwriters in the past have adopted NFPA standards as their own rules, it is reasonable to suppose that the 1945 NFPA code will also become the new Underwriters' code, but at the time this is written the Underwriters have not—"not as yet," they say—taken any such action.

But any projection room changes planned now for postwar installation should be considered with one eye on the new NFPA code, in view of the rather strong possibility that it will become the Underwriters' code before contemplated postwar changes can be put into effect. A complete copy of the new fire code can be obtained through its publisher, National Fire Protection Association, 60 Batterymarch Street, Boston. The National Board of Fire Underwriters are at 85 John Street, New York.

A review of some of the more pertinent paragraphs of the new NFPA code will be given here. The reader may wish to compare them with the resume of Underwriters' requirements in the February 1944 issue of I.P.

Scope of Standards

"These standards are intended to apply to the storage and handling of nitrocellulose motion picture film, in all places except establishments manufacturing such film. . . . They are not intended to apply to the storage and handling of film having a cellulose acetate or other approved slow-burning base. (Cellulose acetate film is used for 16 mm projection—Ed.) These standards are . . . based on minimum requirements for safety to life and property from fire."

Certain paragraphs will now be quoted which, if taken together, would seem to require that every projection room having more than two projectionists MUST have two exits. But this apparently is not exactly what the code means, as will be seen from subsequent paragraphs that deal with projection rooms specifically.

Subsection 3 has this to say: "(a) These standards are divided into two parts: Part I gives general provisions regarding the storage and handling of film; Part II



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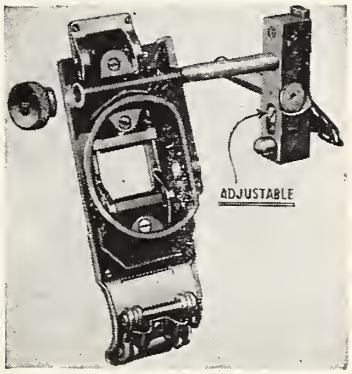
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gives special provisions for special occupancies as motion picture theatres, exchanges, laboratories and studios, which apply in addition to any and all of the general provisions which may also be applicable."

This would certainly seem to mean that all general provisions apply to the theatre projection room, and that in addition there are special provisions applying to theatre projection rooms only. Further bearing out this view, subsection 3 goes on to say: "(b) The grouping of the special provisions under the heading of special occupancies is merely for convenience in the application of these standards. Any particular process or operation in any type of occupancy shall be governed by the provisions given for that process or operation, whether under the heading of that occupancy or any other heading, unless otherwise specifically provided herein.

"For example, any process in a studio which, from the standpoint of the authority enforcing these standards, partakes of the same nature as some process covered under laboratories, shall be governed by the provisions for that process given under laboratories."

Two Exits?

With the above in mind, the reader may be interested in subsection 114, one of the "general provisions" referred to above. It reads: ". . . Rooms in which film is handled and in which more than two persons work shall have two or more exits, remote from each other."

So it might appear that "the authority enforcing these standards"—such as the local fire department, State Police, etc.—could, according to this code, require immediate installation of a second exit in any projection room having two or more projectionists on duty.

On the other hand, the "special provisions" for "occupancy" as a motion picture theatre projection room read as follows—subsection 191 (c): "The entrance door into the enclosure shall be at least 2 feet by 5 feet, of construction equivalent to the sheathing permitted above for rigid frame construction, and shall be self-closing, swinging out, and shall be kept closed at all times when not used for egress or ingress.

"For new construction it is recommended that at least two doors be provided, each not less than 30 inches wide and 6 feet high. Doors should be approved fire doors of a type suitable for use in corridor and room partitions (Class C openings as defined in the Standards on Protection of Openings in Walls and Partitions). Exits should be in accordance with requirements of authorities having jurisdiction, particularly as to size and location. At least one should be of the conventional stairway type, having a suitable landing at the top or should open directly onto a corridor."

As to whether all the foregoing, taken together, means that theatres with more than two projectionists on duty must have two-exit projection rooms now at once, or not, is perhaps something the "authorities having jurisdiction" can decide, or lawyers can argue about.

Stringent Rules

Some standards that surely are not followed in very many projection rooms the country over include these:

Subsection 123: "Light fixtures shall be firmly fixed in place, and lights shall be protected by vapor-tight globes. All lights shall be equipped with keyless sockets and operated by wall switches."

Subsection 125: "Portable electric lights on extension cords shall not be used in any room in which film is handled or stored, other than the stage of motion picture studios, except that in emergency such portable lamps may be used if equipped with approved keyless sockets and metal protective lamp guards, and having rubber-covered cords of the Hard Service (type S) or Junior Hard Service (type SJ) varieties, with suitable locking plugs."

According to this, the reader's own projection room may need a bit of rewiring, and replacement of dime store or homemade trouble lamps with ap-

(*Continued on page* 30)





NTS PUBLISHES GUIDE FOR DRIVE-IN THEATRES

National Theatre Supply, in keeping pace with the steadily increasing interest in drive-in theatres, has issued a 24-page book designed to assist prospective outdoor theatre owners in planning drive-ins which will prove profitable ventures. According to A. J. Lindsley, of the N. T. S. sales promotion department the new book contains a number of new and unusual features, including interesting illustrations of the drive-in theatre of tomorrow—individual speakers of an entirely new design, theatre plans, construction notes, photographs and detailed descriptions of all principal equipment required, a complete check list of equipment and supplies necessary, and a special page of drive-in theatre facts in question and answer form.



IN THE SPOTLIGHT

(*Continued from page* 17)

membership for the Hank Leslie (former 348 secretary) article that appeared in our May issue.

". . . The story received much congratulatory comment and the members now regard I. P. as a family magazine of the IATSE in addition to being a medium of education. Please accept our thanks for all your efforts on our behalf and for the friendly note you add to I. P. . . ."

Our thanks to you, George, and to the members of Local 348 for "them kind words."

● A very fine record has been established by the members of Chicago Local No. 110 in the various war bond drives. In the last three drives they purchased war bonds totalling over three quarters of a million dollars, to wit: 5th war loan drive, $176,386; 6th drive, $271,421; 7th drive, $303,550, a grand total of $751,357 in war bonds.

● Last December we printed an item on holidays with pay for projectionists and asked our readers for their opinions on the subject. We were amazed at the response received from local unions throughout the Alliance endorsing our stand. For obvious reasons, many of the writers stated that although they had no objections to their letters being printed, they wished their names to be omitted. One of our correspondents, however, Jack Teitler, former Local 306 Brooklyn business agent, placed no such restrictions upon us and his letter is typical of quite a few we received. He writes:

Dear Harry:

Through bitter experience you and I know that it takes a heck of a long time to make some people 'catch on' to the good things you try to do for them. I say this because of your article in the December 1944 issue of I. P. relative to holiday pay for projectionists.

Let me cite a case in point. During my term as business agent (1938-1943), I negotiated with the Lindy Theatre in Brooklyn, whose contract was up for renewal. I asked for a 40 hour week, time and a half for overtime, and double pay for Sundays and legal holidays. The exhibitor offered an increase of 15% (along the lines of the Little Steel formula) which we refused. A strike was threatened and the case brought before the U. S. Labor Department.

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NEW NEPA CODE

(*Continued from page* 28)

proved manufactured types.

Subsection 132 provides: "All steam pipes within 6 feet of the floor, and where passing through partitions or racks or near woodwork, shall be covered with approved pipe covering. All radiators, heating coils, and pipes and returns that are near the floor or are so located as to permit any combustible material, waste or dirt to come in contact therewith shall be guarded and protected by means of ¼-inch mesh galvanized steel wire cloth No. 20 B. & S. Gauge, or by its equivalent. The bottoms of such guards shall be arranged so as to lift up for cleaning purposes, and the tops to slope so that guards cannot be used as shelves. Guards shall be so constructed that no film can come within 4 inches of the heating surface, and shall be made with a substantial metal frame work which will prevent the wire mesh being forced against the radiator or pipes."

Cabinet Requirements

Film Cabinets. According to Section 16, dealing with film cabinets:

"Cabinets shall have a capacity of not in excess of 375 pounds of film (75 standard rolls)." (A standard roll is a 1,000-foot reel.—Editor, I.P.)

"Racks in the cabinet shall be of metal and so arranged that containers will be stored on edge only.

"Doors shall close tightly against the jambs, and should be so arranged as to remain normally closed and latched.

"Cabinets having a capacity of over 50 pounds of film (10 standard rolls) shall be provided with a vent from each compartment to the outside of the building. The vent shall have a minimum effective sectional area of 14 square inches per 100 pounds of film capacity. For long lengths of vent pipe a larger size may be necessary to take care of friction loss and turns in the pipe.

"Vent flues shall be of construction equivalent to 18 U.S. gauge riveted sheet metal, and where inside the building shall be covered with 1 inch of approved heat insulating material.

"Cabinets holding over 75 pounds of film (15 standard rolls) shall be provided with at least one automatic sprinkler; provided, however, that a cabinet constructed so that each roll is in a separate compartment and will burn out without communicating fire to film in any other compartment need not be provided with an automatic sprinkler.

". . . Materials other than film shall not be stored in the same cabinet with film."

Projection room. Size and structural requirements of the projection room are substantially identical with those already reprinted from the Underwriters' code in I.P. for February 1944. Additionally, the NFPA publication recommends:

"For new construction, it is recommended that the walls of the enclosure be constructed in accordance with the requirements of subsection 112, paragraphs (1), (2), or (3), for partitions, with floor and ceiling of equivalent fire resistance."

The paragraphs referred to read as follows:

"(1) Hollow clay tile laid in cement mortar, cement lime mortar, or gypsum mortar, not less than 4 inches thick and plastered on both sides with not less than ½ inch of gypsum mortar or cement mortar;

"(2) Gypsum blocks, either solid or hollow, laid in gypsum mortar, not less than 3 inches thick and plastered on both sides with not less than ½ inch of gypsum mortar;

"(3) Metal lath supported by incombustible studs, plastered on both sides to fully cover the metal lath and studs with not less than ¾ inch of gypsum mortar or cement mortar and having a total thickness of not less than 2½ inches."

Rewinding. (Section 21).

"Rewinding of films shall be performed either in a special rewind room at an approved location, or in the projection room. If done in the projection room, approved enclosed-type rewind machines should be used.

"An approved can for scrap film having a self-closing hinged cover shall be provided.

"Rewind rooms shall be at least 80 square feet in area . . . and shall have a vent to the outside of the building of not less than 27 square inches. . . .

"No collodion, amyl acetate or other similar flammable cement or liquid in quantities greater than 1 pint shall be kept in the projection booth or room or rewind room.

"Splices in film shall be made on mechanical cutting and splicing machines."

Operation. (Subsection 217).

"Motion picture projectors shall be operated by and be in charge of qualified projectionists, who shall not be minors."



SIMPLEX CITED BY NAVY

Rear Admiral Woodward, U. S. Navy, has sent the following telegram to the International Projector Corporation, manufacturers of Simplex projection equipment: "One of your portable sound projectors is cited as an important factor in the high morale shown by the heroic crew of the U.S.S. Franklin, which Jap bomb hits recently left ablaze and exploding off Kyushu, belying the Jap claims of her sinking.

"The Franklin men not only kept her afloat but got her home 12,000 miles under her own power. Your sound projector has been an unfailing source of entertainment and relaxation to the carrier's personnel during the entire period when she logged 102,000 miles on extensive war missions, including two invasions and several strikes against Japan, Formosa and the Bonins. All of you may take deep satisfaction that your motion picture equipment helped to maintain the spirit and fighting efficiency of the men of this gallent ship."

Simplex projectors and sound systems are distributed exclusively by National Theatre Supply through their 28 branches from coast to coast.

FRANCES PERKINS

(*Continued from page* 20)

trial Commissioner, she was largely instrumental in obtaining the passage of the 48-hour law, which limits the hours of labor of women and minors in mercantile establishments to 8 a day or 48 a week. This law became effective July 1, 1931.

On March 4, 1933, she took office as Secretary of Labor in President Roosevelt's Cabinet.

President Roosevelt appointed her chairman of the Cabinet Committee on Economic Security which made the report upon which was based the Social Security Act providing for unemployment compensation, old-age pensions and old-age insurance, mothers' pensions, aid to crippled children and to the blind.

As Secretary of Labor she has advocated shorter hours of labor, abolition of child labor, a sound minimum-wage law, generous workmen's compensation insurance, strict laws for machinery safeguards to prevent accidents, prevention of occupational diseases by the removal of noxious poisonous dust and gases and fumes from places of employment, better safety and health protection in working places.

She advocated greater cooperation between the States and Federal departments and to this end inaugurated regular national and regional conferences aimed to raise standards of labor legislation so as to benefit the individual wage earner, employer, and investor.

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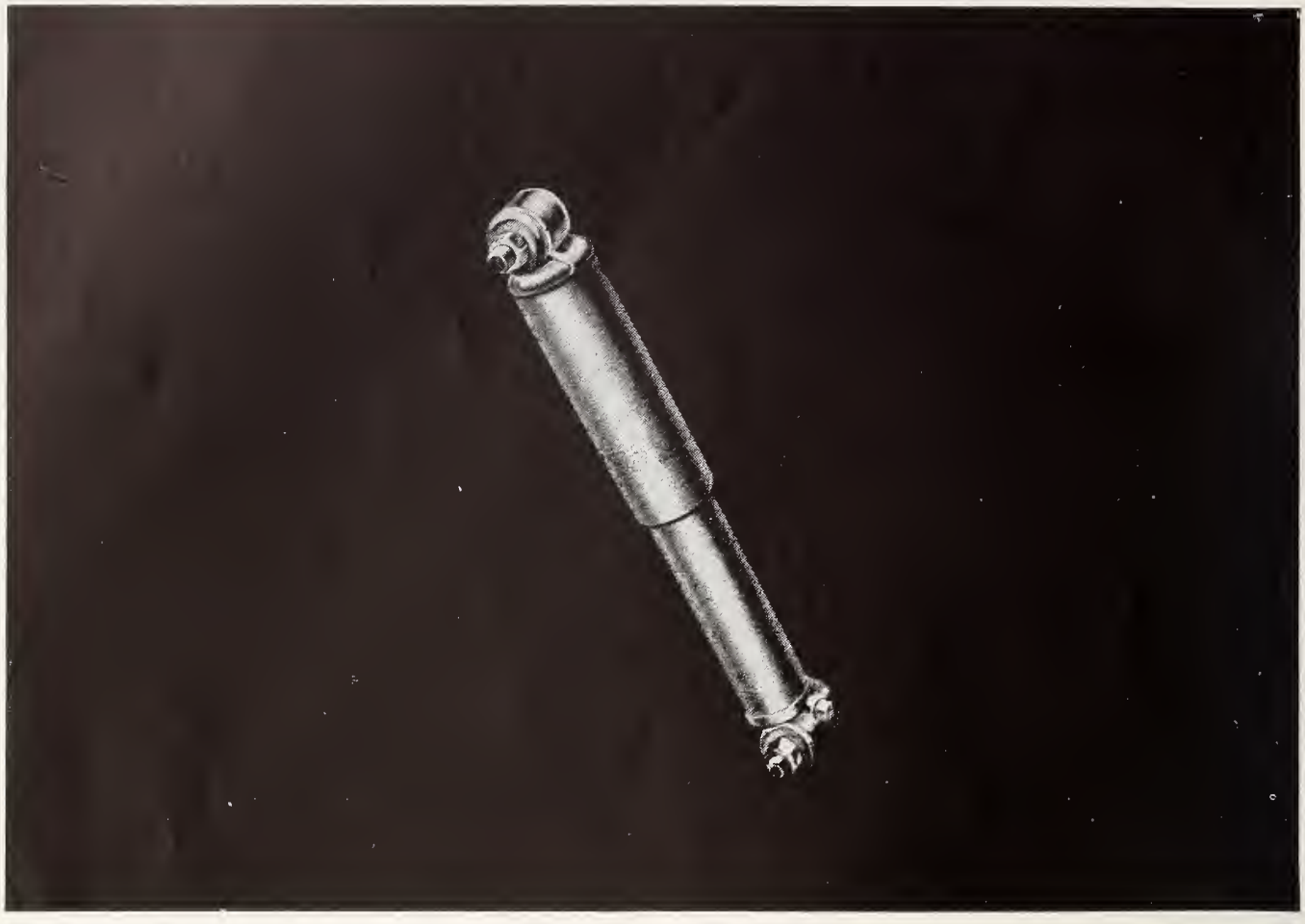
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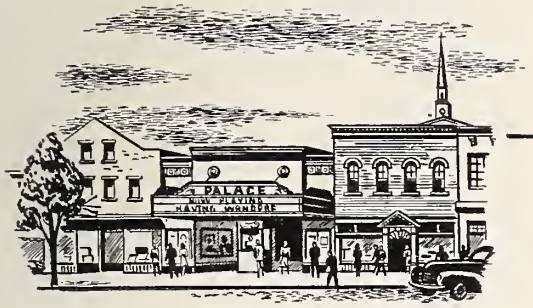
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INTERNATIONAL PROJECTIONIST

With Which Is Combined PROJECTION ENGINEERING

W. L. Lightfoot, *Associate Editor*

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MONTHLY CHAT

INDICATIONS are that the country is going to return to a normal civilian economy in the fastest possible time, now that the job in the Pacific has been completed. In our own industry, which has done much to uphold morale since Pearl Harbor, critically needed replacements will be available before long. Projectionists are to be congratulated on the manner in which they have kept the show going with the equipment available. The job done was an excellent one. And now that the world is at peace we can look forward to a new era that will usher in widespread advancements in the field. Projectionists should be more alert than ever before in keeping abreast of the changing picture.

• • •

D. W. Lansing, recording sales manager of the RCA International Division, recently made some pertinent statements regarding world conditions, indicative of the tremendous educational and opinion-forming forces behind motion picture sound films. He pointed out that the production of sound films today is occupying a prominent part in the thinking and planning of nations, with governments encouraging motion picture industries within their own borders and themselves producing educational and documentary films. Ministers of various government agencies, he emphasized, now are laying plans for the use of sound motion pictures for education and training, and to aid in programs of employment and international trade. "Nations are more and more thinking of the motion picture sound film in terms of a powerful technique of information and a modern tool of information," he said.

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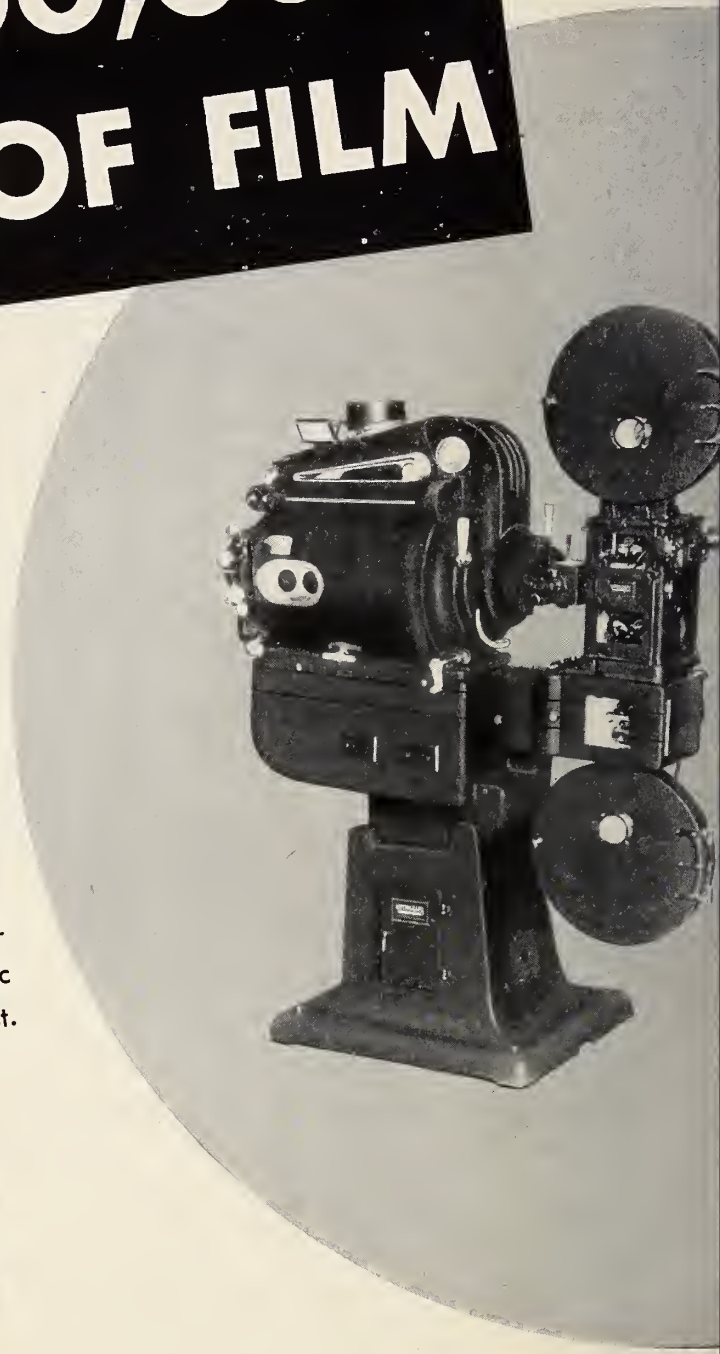
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INTERNATIONAL PROJECTIONIST

VOLUME XX AUGUST 1945 NUMBER 8

PROJECTION TELEVISION†

By *D. W. EPSTEIN** and *I. G. MALOFF***

PEOPLE who have recently observed television programs are very pleasantly surprised to find that the brightness and resolution of the picture are quite satisfactory for entertainment purposes, but they express some dissatisfaction with the size of the picture—about 7 x 9½ in. This desire for larger pictures probably results from their experience with motion pictures. No amount of dissuasion or argument—such as, it is not the size of picture that matters but the angle subtended by the picture at the observer's eyes, or no one objects to the size of photographs in magazines, one simply observes them at close range—seems to decrease their desire for larger pictures.

Since the size of the picture obtainable on the face of a cathode-ray tube is definitely limited, means have to be found to enlarge the picture. An obvious means for obtaining larger pictures is to magnify the picture on the cathode-ray tube optically, by placing a lens in front of it. However, this means of enlarging the picture is of very little practical use since it limits the field of view very badly.

Another means for obtaining larger pictures is by the same means that is used in motion pictures, that is, by projection. Projection television is the projection onto a viewing screen of the television picture occurring on the luminescent screen of the cathode-ray tube. Projection television seems at present to be the most practical way of obtaining larger television pictures than are feasible with direct viewing cathode-ray tubes.

Basic aims of RCA television research have been to develop both home and theatre projection television. The two outstanding problems of projection television that had to be solved are:

(1) Developing a cathode-ray tube capable of producing very bright pictures with the required resolution; and

(2) Providing an optical system as efficient as possible so as to utilize the largest possible percentage of the light generated by the cathode-ray tube.

These problems were very vigorously attacked during the five years prior to our entry into the war and the progress made toward their solution was very satisfactory.

The progress made toward the solution of the cathode-ray tube problem resulted primarily from the development of cathode-ray tubes capable of operating at high voltages. This was the result of intensive work on electron guns, luminescent materials, glass envelopes, etc. Thus, by the beginning of 1940 cathode-ray

Projection television, which is simply the projection onto a viewing screen of the picture originating on a cathode-ray tube seems, at present, to be the most practical means of producing large television pictures.

The two basic problems of projection television are: (1) the problem of providing a cathode-ray tube capable of producing very bright pictures with the necessary resolution and (2) the problem of providing the most efficient optical system so as to utilize the largest possible percentage of the light generated. These problems were very vigorously attacked over a period of years and the progress made toward their solution has been very satisfactory.

Problem (1) has been solved largely by the development of cathode-ray tubes capable of operating at high voltages. Problem (2) has been solved by the development of a reflective optical system about six to seven times more efficient than a good f/2 refractive lens. The reflective optical system consists of a spherical front face mirror and an aspherical correcting lens.

A handicap of this optical system, for use in a home projection receiver, was the high cost of the aspherical lens. This has been overcome by the development of machines for making aspherical molds and by the development of a process for molding aspherical lenses from plastics. RCA reflective optical systems are designed for projection at a fixed throw and require cathode-ray tubes with face curvatures fixed in relation to the curvature of the mirrors in the system. A number of such systems, suitable for projecting television pictures with diagonals ranging from 25 in. to 25 ft. have been developed.

† Soc. Mot. Pic. Eng., June, 1945.

* RCA Laboratories, Princeton, N. J.
** RCA Victor Division, Camden, N. J.

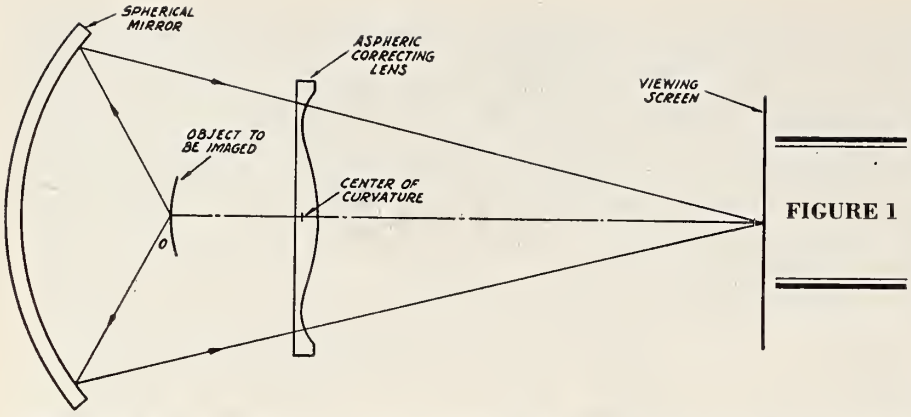


FIGURE 1

Optical system consisting of a front surface spherical mirror and a weak non-spherical correcting lens located at the center of curvature of the mirror.

tubes had been developed which were capable of delivering more than 150 cp, whereas in 1935 the top was 10 cp—an improvement of over 15 to one.

In the beginning of the development, the problem of providing an efficient optical system appeared to he very formidable. In a television projection system the picture to be projected originates on the luminescent screen of a cathode-ray tube. For practical purposes, this screen radiates light as a perfectly diffusing surface. In projecting the light from a perfectly diffusing surface onto a viewing screen by means of a conventional lens, by far the greatest part of the light does not reach the viewing screen. In fact, a lens with a relative aperture of *f*/2 can at most collect only 6.25 per cent of the light emitted by the cathode-ray tube. Actually it collects appreciably less.

Reflective Optical System

For a given power input to the cathode-ray tube the larger the tube face the greater the candlepower output. So it was necessary to provide an optical system capable of focusing large fields with high efficiency. A few per cent improvement of efficiency was of no interest. Manifold increase in the percentage of light delivered to the viewing screen was sought. In other words, an optical system was sought which would be able to cover up to 50-degree fields and would have an efficiency of 20 to 40 per cent instead of the 6 per cent of an *f*/2 lens. The answer was found in a reflective optical system consisting of a front face spherical mirror and a weak aspherical correcting lens located at the center of curvature of the mirror. A schematic diagram of such an optical system is shown in Figure 1.

The outstanding advantage of an optical system such as that shown in Figure 1 over a more conventional optical system is its ability to focus a large field (large tube diameter) with a large relative aperture. This system possesses this property primarily because a spherical mirror with an aperture located at the center of curvature of the mirror suffers from only two aberrations — spherical aberration, which is uniform all over the field, and curvature of the field. This may be seen from Figure 2; here C is the center of curvature of the mirror and O_1 and O_2 are object points located on the axis and off the axis, respectively.

Figure 2 shows the ray paths for these two object points with the aperture located at the center of curvature. It is seen that the image or rather circle of least confusion, since spherical aberrations is present, is practically of the same size and symmetry for both object points. The reason for this is that the principal ray, i. e., the ray passing through the object point and center of aperture, also passes through the center of curvature of the mirror and is therefore also an axis of symmetry for the sphere. The only difference is that the circular aperture mounted perpendicular to the principal axis and therefore symmetrically located with respect to the principal axis is nonsymmetrically located with respect to the auxiliary axis. This causes some nonsymmetry in the light distribution of the circle of least confusion; however, this nonsymmetry becomes of importance only in the case of very large fields (large objects).

The object of the correcting lens is to correct for the spherical aberration of the mirror without introducing any serious aberrations in itself. This is accomplished by making the correcting lens as weak as possible and locating it in the plane of the aperture at the center of curvature. In this way, the symmetry property of the spherical mirror is least disturbed. The curvature of the field is not corrected and is such that it is actually of advantage for cathode-ray tube projection.

The spherical aberration of the mirror may be looked upon as focusing by means of zones, each zone having a different focal length. The correcting lens has to be such that each zone of the correcting lens has a different focal length, and such that it just compensates for the various focal lengths of the mirror; the result is a focusing system all zones of which have the same focal length.

Effect of Correcting Lens

The shape of the correcting plate must be such that all rays emanating from an object point O, and reflected by the mirror, shall meet at the image point I located at a distance S from the correcting plate. Figure 3 shows three rays emanating from O and striking the mirror at different apertures. Without the presence of the correcting lens rays *1*, *2*, and *3* would intersect the axis at distances q_1, q_2, and q_3 from the center curvature. The slopes on the correcting lens have to be such (approximately as shown in this figure) that all three rays intersect at I, i. e., the correcting lens has a flat at the point where ray *2* passes, negative slope where ray *1* passes, and positive slope where ray *3* passes.

Considered from the point of view of spherical aberration, if the zone where ray *2* strikes the mirror is taken as the reference, then the mirror has negative spherical aberration for smaller aper-

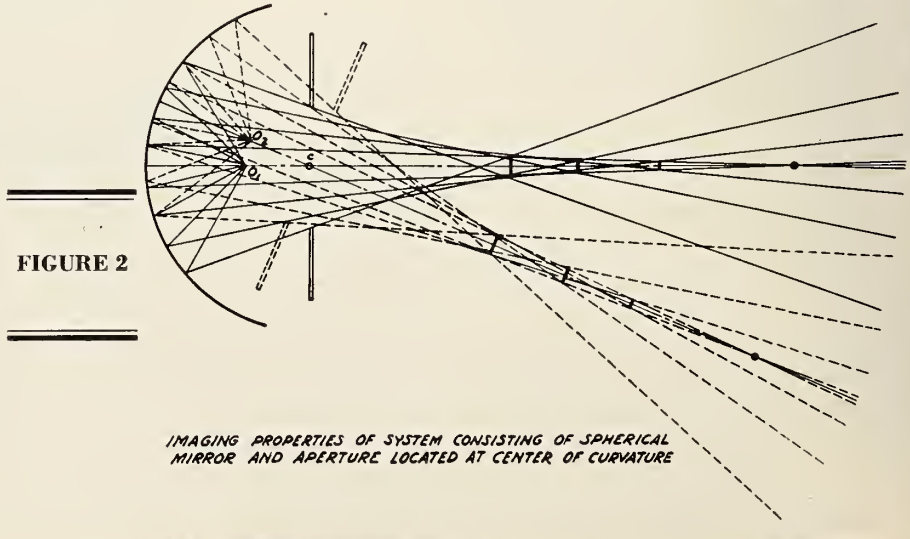


FIGURE 2

IMAGING PROPERTIES OF SYSTEM CONSISTING OF SPHERICAL MIRROR AND APERTURE LOCATED AT CENTER OF CURVATURE

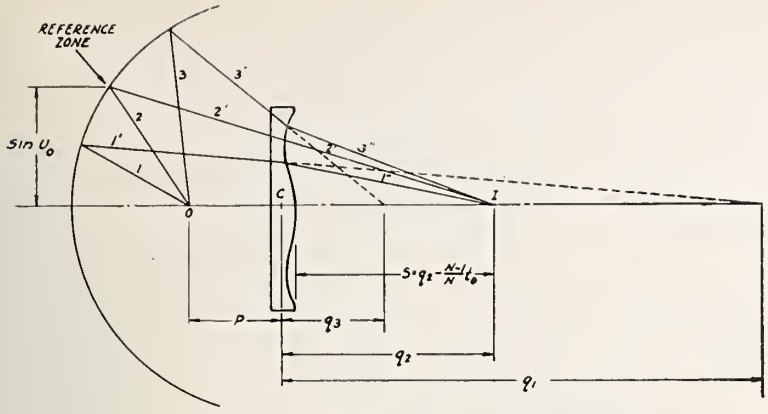


FIGURE 3

CORRECTION OF SPHERICAL ABERRATION BY CORRECTING LENS

tures and thus requires a positive lens for correction, and positive spherical aberration for larger apertures and thus requires a negative lens.

Since the mirror with an aperture at center of curvature has no extra-axial or chromatic aberrations, these aberrations are caused by the correcting lens itself, i. e., by the power or slopes on the correcting lens. From the standpoint of the aberrations, therefore, that shape should be chosen whose maximum slope is the least. Thus, if the paraxial (central) focal length of the mirror is chosen as that of the system, then the central focal length of the correcting lens is infinite and the shape of the curve is concave.

Alternatively, if a zonal focal length of the mirror is chosen as that of the system, there will be a zonal focal length of the correcting lens which is infinite and the shape of the curve is convex at the center and concave past this zone. If a peripheral focal length is chosen, the required correcting lens is convex. The maximum slope is least for a convex-flat-concave curve.

The shape and size of the correcting lens depend upon the throw or magnification for which the system is to be used. For a given focal length and relative aperture the correcting lens aperture decreases as the magnification decreases. That this must be so, may be surmised from the fact that for unity magnification the lens aperture is zero, since object and image coincide at the center of curvature.

Figure 4 shows the variation of correcting lens semiaperture and mirror semiaperture with magnification. Thus a different correcting lens is required for each throw or magnification. The reason for this is that a high relative aperture optical system can be well corrected for only one position of object and image. The throw or magnification tolerance for a given correcting lens decreases with increased relative aperture for a given resolution.

In order to obtain a flat image field, i. e., focus on a flat-viewing screen, it is necessary that the object field or tube face be curved. Calculations show that in general the shape of tube face depends on the throw—a sphere for infinite throw and an ellipsoid for finite throw. The eccentricity of the ellipsoid is sufficiently small, however, so that even for finite throw the tube face may be made spherical with a radius of curvature equal to that of the focal length of the system.

The projection efficiency of any optical system will be defined as the fraction of the total light flux (say, in lumens) emitted in a forward direction by an axial element of a nondirectional source, such as the luminescent screen of a cathode-ray tube, that the optical system accepts and focuses on the corresponding image element, assuming that the mirror reflects 100 per cent and the lenses transmit 100 per cent.

The efficiency, e, as defined above is given by $e = \sin^2 U$ where U is the semi-apex angle shown in Figure 5. Hence, to determine the efficiency of a lens, for a perfectly diffusing source, it is merely necessary to know the angle that the lens (or entrance pupil) subtends at the source. As may be seen from Figure 5, the farther a given lens is from a source, i. e., the less the magnification, the lower the efficiency of the lens.

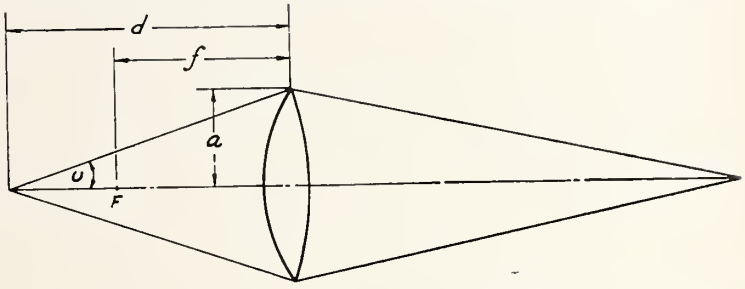


FIGURE 5

Illustration by means of a simple lens that efficiency decreases with magnification.

It has become customary to rate a lens by its f/number for infinite magnification, i. e., object located at the focal point of the lens.

The smallest f/number possible is 0.5, since at 0.5 the efficiency is unity and all the light emitted by the object element in a forward direction is concentrated at the image element. Figure 6 shows the efficiency e_∞ of a lens as a function of f/number. It is seen that the efficiency of most lenses is very low.

The efficiency of a given lens decreases when the magnification or throw decreases. This factor becomes of importance in the case of home projection where magnification as low as five may be used. Thus an ordinary $f/2$ lens having an e_∞ of 6.25 per cent will have an efficiency of 4.6 per cent when used for a magnification of six.

Since the reflective optical systems under consideration are designed for a

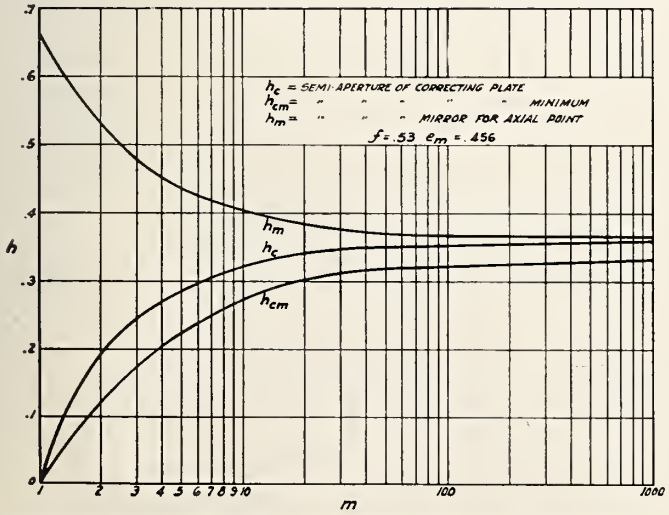


FIGURE 4

Variation of semiapertures of correcting lens and mirror with magnification.

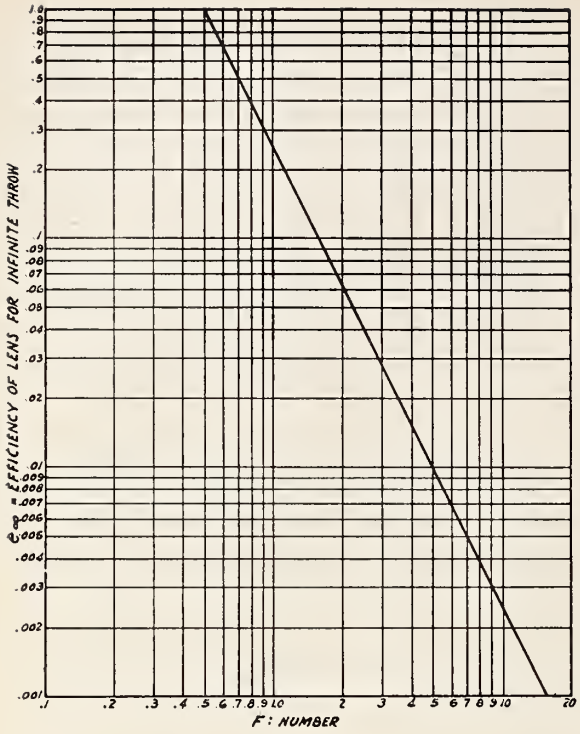


FIGURE 6
(Left)
Variation of lens efficiency with its f/number.

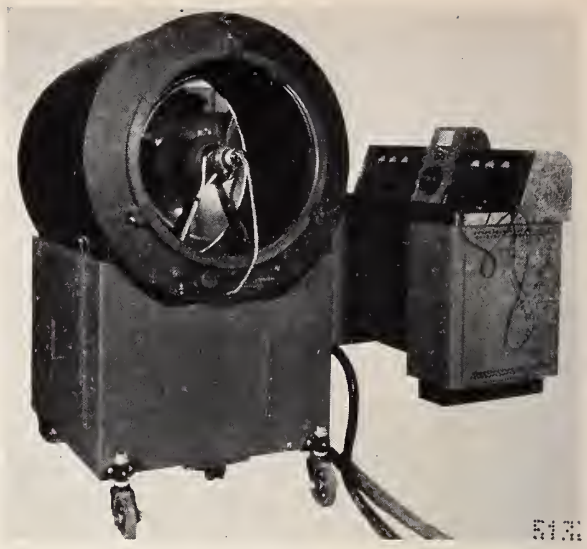


FIGURE 7
(Right)
RCA theatre television projector with control console in background.

specific magnification and since the central part of the system is masked to maintain contrast, this part being blocked by the cathode-ray tube, it seems preferable to rate such systems by their efficiencies rather than *f* number.

In the RCA systems the efficiency with no masking is about 40 per cent and the efficiency of the central part of the system that is masked is approximately 10 per cent so the efficiency of the system with blocking will be about 30 per cent. Hence, neglecting losses in the system, about 30 per cent of the light emitted by an axial point will be focused into an image point. This corresponds to the efficiency of an *f*/0.8 lens used at a magnification of six.

There are two distinct applications for projection television, namely, theatre television and television receivers for home use. (A description of the RCA theatre television system was published in the July, 1941, issue of the *RCA Review.*) The optical system consists of a 30-in. diameter mirror and 22.5-in. diameter correcting lens. Figure 7 shows the optical system with the cathode-ray tube in place. The control console may be seen in the background.

An arrangement of parts in a self-contained projection television receiver is shown in Figure 8. Here the optical system is mounted near the floor with its axis vertical, projecting the image straight up and onto a flat mirror inclined at 45 degrees to the incoming beam of light, and throwing the image on a translucent screen. Such an arrangement presents the advantages of compactness, relatively small depth of the cabinet, and can be styled along the familiar lines of a radio console.

A number of such reflective projection systems suitable for home receivers of the type described have been designed, built, and operated in actual receivers. The smallest of these was built for use with a cathode-ray tube having a face diameter of 3 in., and consists of a spherical mirror 9 in. in diameter and a correcting lens 6 in. in diameter. The largest has tube, mirror, and lens diameters of 5, 14, and 9.5 in., respectively. A number of systems in sizes intermediate between the two just described have been built. The throw or distance between the correcting lens and the viewing screen varied between 36 and 54 in. and the optical efficiencies were between 18 and 35 per cent. In resolution and contrast these systems compare favorably with well-corrected conventional projection lenses.

Aspheric Correcting Lens Costly

The major objection to the use of reflective optics in home projection receivers was the high cost of the aspheric correcting lens. The spherical mirror, while quite large, is an old and familiar item to the well-established optical industry, as most of the conventional optical surfaces are spherical and are easily made. The aspherical correcting lens similar to a figure of revolution developed by rotating a shallow letter *S* around one of its ends, presented an altogether different problem. Unlike the spherical mirror such a figure is not a naturally generated surface and there are no machines on the market for straightforward production of such surfaces. True enough, astronomers, with their traditional patience and lack of hurry, produced excellent aspherical lenses on machines used for making astronomical instruments, but only by tedious step-by-step methods.

In the early stages of the development RCA used methods and machines copied from astronomical techniques. Exceedingly high cost of experimental reflective optics resulted. The gain in light over the conventional projection lens was very attractive, but the cost of such individually produced lenses was prohibitive. The apparent solution to the cost problem was that of molding the aspherical lenses from some transparent material. A development project was undertaken and soon was concentrated on the investigation of a clear thermoplastic material known under the name of methyl methacrylate, and sold under the registered

(*Continued on page* 27)

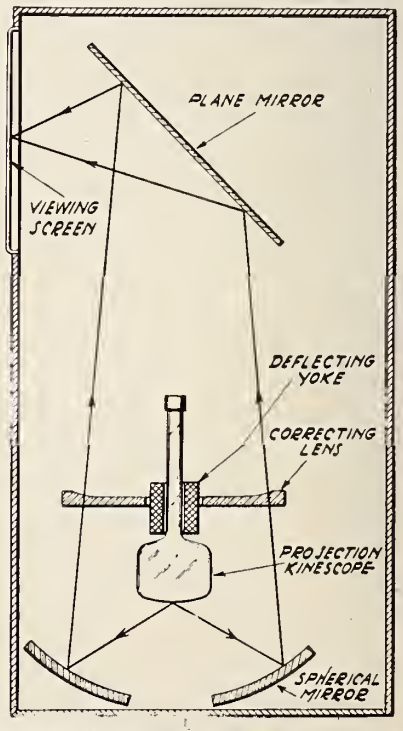


FIGURE 8. ***Optical system of television projection receiver.***



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Movies, in generous doses repeated frequently, are valuable therapy...speed many a wounded man through convalescence to recovery by taking his mind off his understandable worries...

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Some Common and Uncommon Remedies for Hum in Sound Systems

By *LEROY CHADBOURNE*

Useful and practical observations on the cure of rhythmic sound disturbances of all kinds (including those that originate outside the sound system) are presented in this discussion.

NO TYPE of theatre trouble is so common as hum, and none is so insidious. There is always some degree of hum in any sound system, and it may increase in strength so gradually that projectionists do not always realize when it has reached the level of being annoying to the audience. The variety of hums, moreover, is practically unlimited.

One way of classifying these disturbances is to draw a distinction between those that are, and are not, of line frequency. Any projectionist who is not perfectly certain what line frequency hum sounds like can always refresh his memory by illuminating his photocell with a trouble lamp. This distinction, so easily made, helps greatly in running down the causes for trouble of this kind.

Another distinction, less easily made but very useful in trouble-shooting, is that between hums originating within the sound system and those having an external cause.

Hums of External Origin

A huge family of troubles is caused by the operation of nearby machinery which has nothing to do with the sound equipment, or even with the projection room. Sign and marquee flashers, air conditioning apparatus, and even a refrigerator in an ice cream store down the street have been known to produce hum in sound systems. Projection room equipment other than sound apparatus also is often guilty; in this connection the arc feed motor is a common offender, while transformers associated with incandescent lamphouse or with a.c. arcs have also been found at fault. Rectifiers and motor generators associated with d.c. arcs can produce hum in the loudspeakers under some circumstances. Any electrical machinery, in short, whether located in or out of the projection room, is a possible suspect. It need not be at all close to the sound system. The power supply lines, or the ground connections of the sound system, may carry the disturbance.

An externally-caused hum need not be of electrical nature at all. A mechanical vibration can be picked up through a microphonic tube or connection and manifest itself as a current hum frequency in the sound circuits.

Possibly, however, the commonest kind hum of external origin is one of the power line frequency, which gets into the sound circuits by reason of improper grounding.

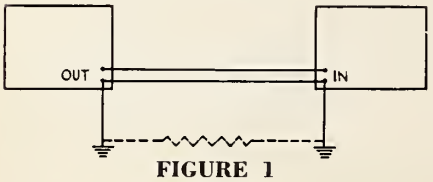


FIGURE 1

Hum Pickup Through Ground

Figure 1 illustrates the idea of two different grounds which are "at different potentials" because of poor, or loosened, or corroded ground connections. A difference of potential (voltage) cannot exist across a perfect short circuit. But a difference of potential can exist across a poor connection. If, in Figure 1, either of the two ground connections is imperfect, the electrical condition resulting will be the same as if a resistance (indicated by the dotted line) were connected between the two ground wires. A difference of potential at line frequency can exist across that phantom resistance.

Suppose the two rectangles of Figure 1 represent two amplifiers, with the output transformer of one connected to the input transformer of the other. Then, regarding the phantom resistor as a source of line frequency voltage, current will flow, say, from the lefthand side of that resistor, up to the lower connecting wire, right and down to the other side of the source of potential.

But a parallel path will exist as follows: up, through the secondary of the output transformer of the lefthand amplifier, right through the upper connecting wire, down through the primary of the input transformer of the righthand amplifier, and back to the right side of the resistor. This second path will be substantially shorted by the lower connecting wire (which may be the shield of a coaxial cable); nevertheless, some small current has been caused to flow through the input transformer of the righthand amplifier. If the gain beyond that point is great enough, hum will be heard.

The remedy is get rid of the phantom resistor, across which a voltage drop exists, and which is, therefore, a source of hum voltage. One way of doing this is to secure perfect connections at both ground terminals; a second and perhaps better way is to eliminate one of those grounds. The condition diagrammed in Figure 1 cannot exist if the whole sound system is grounded to earth at one point only. However, the pre-existing power line grounds may make this impossible.

A safe test in the case of any stubborn hum, and one easy to apply, is to check all the earth connections, and particularly those of the sound system. Remove them one at a time, clean, replace and tighten them. If the process of removing any ground connection reduces the hum, it may be that that connection can be dispensed with permanently.

If hum of external origin cannot be kept out of the sound system by means of good grounding, it may be necessary to cure it at its source. This will involve improving or filtering the external machinery or circuit that is the cause of the trouble.

Treating External Sources

In rare cases the power supply circuits themselves are the cause of line frequency hum. If other possible causes have been exhausted the power company will cooperate. They want no poor connections in their own lines or grounds.

More common by far is the condition in which some machine inside or outside the projection room is the cause. By switching on and off all possible machinery (most of this will have to be done after the show) the faulty device can be found if it is in the theatre at all. If it is not found, suspect refrigerators, heavy motors, dentists' or doctors' X-ray machines and so forth in the immediate vicinity of the theatre. The power company can help by advising which nearby circuits are on the same line that supplies the projection room. Once the device that causes the trouble has been located, four possible remedies are open.

First of all, if the machine is in faulty

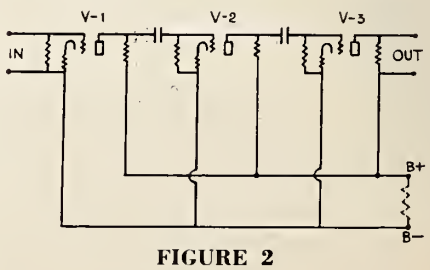


FIGURE 2

condition, it can be repaired or improved. Thus, dressing marquee flasher contacts, or sanding a poor commutator, may turn out to be the only remedy needed.

If improving the device does not end the trouble, filtering may. The simplest filter is a fairly large capacitor connected across the line supplying power to the device in question. An improvement on this is the procedure of grounding both sides of the supply line through capacitors. The usual way of doing that is to wire two capacitors in series, connect them across the line, and ground the centerpoint between the capacitors. More elaborate line filters can be purchased in normal times.

Third, the fault may lie with imperfect grounding of the device causing the trouble. Check its ground connections, and also check the electrical bond between any shielding or casing and the conduit through which power is supplied.

But hum is a curious thing for which there are no sure-fire remedies predictable in advance. A fourth step that sometimes works when others fail is to insulate the conduit. Thus, in the case of transformers which supply a.c. for an a.c. arc or projection incandescent, hum has been cured by insulating the casing of the transformers from the conduit that connects to the power source or from the conduit that connects to the projectors.

When the external source is mechanical in nature, such as vibration of a floor or wall that mounts a sound amplifier, correction at the source is apt to be impracticable. Neither should it be necessary to cushion the amplifier. Something—a tube more probably, but possibly some other part or connection—is acting like a microphone with respect to that mechanical vibration. Suspect the tubes and other parts associated with the early stages of amplification—that is, those stages which are followed by high gain. Flick the tubes with a fingernail or pencil, and do the same with other parts, especially potentiometers. Tug at the wiring to find an imperfect connection. If a microphonic part or connection exists it will reveal itself by making plenty of noise in the monitor speaker when these tests are applied.

If tubes of the same kind are used at several points in the sound system one that is too microphonic for an early stage can be safely installed in another socket which is not followed by very high gain.

Hums of Internal Origin

Hums of strictly internal origin may be picked up in very much the same way as those originating outside the sound system. Thus a microphonic tube, photocell, or other part mounted in a soundhead will pick up the mechanical vibration of the projector. So will an imperfect exciter lamp or any loose component in the sound optical train. The remedy is obvious.

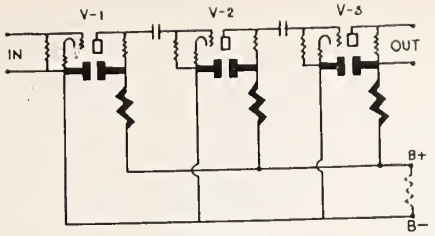


FIGURE 3

Mechanical hums of internal origin include sprocket hole and frame line modulation of the exciting light. The projectionist can always remind himself what those hums sound like by intentionally displacing the film laterally; and the remedy, of course, is to readjust the lateral film guides.

Electrical hums are very readily picked up from the power wiring inside an amplifier or other sound component. Either poor connection or poor insulation, particularly when associated with the grid circuit of a vacuum tube, is subject to electrostatic induction and will readily introduce line frequency hum into an amplifier's speech circuits. An open in the grid line (sometimes existing inside the tube itself) will invariably create hum if the tube is followed by even reasonably high gain. Leakage between grid and cathode owing to poor insulation may do the same thing. A layer of carbon dust settling on the insulation between grid and cathode may produce sufficient leakage. And an open inside a coupling capacitor should always be suspected.

Tapping the tube, its grid connections and coupling capacitor, or tugging at their wiring, usually will reveal the location of the fault by the noise these tests create in the monitor.

Figure 2 represents a common amplifying circuit except for omission of "decoupling" resistors and condensers. Amplifiers corresponding to Figure 2 have been used; they work, but they must be designed for very low gain only. Any attempt to use the circuit of Figure 2 at high gain will cause the amplifier to "oscillate"—act as a d.c. to a.c. generator, producing an alternating current of a frequency determined by the inductance, capacitance and resistance of its circuits. This frequency may be so high as to be inaudible, or it may be so low that the amplifier will motorboat. Then again, it may be a typical hum frequency or, very probably, a high-pitched howl or squeal.

Amplifier Faults

Any system containing amplification will "oscillate" if the output power is fed back to the input circuits in sufficient strength and in suitable phase relationship. (In inverse feedback, used for improving amplifier quality, the feedback is 180 degrees out of phase, and therefore does not cause oscillation.)

In Figure 2, trace the output circuit. Take the plate and cathode of V-3 as the terminals of a source of amplified speech voltage. From plate trace down through the plate resistor, down and right to the dotted line resistor, left and up to the cathode of V-3. Note that the dotted line resistor is in series with the speech current of the output tube, and, therefore, a voltage drop at speech frequency must exist across it.

The dotted line resistor represents the impedance of the source of plate voltage, whatever that source may be. It usually is a rectifier circuit. It may be a generator, or vibrator, or B battery. In any case it will have impedance, and since the speech current of V-3 flows through it, a voltage drop of speech frequency exists across it. It will, therefore, act as a source of speech voltage for any other circuit connected across it.

Now, start at the top of the dotted line

Projection Historical Committee Records Achievements of Craft

FOR a considerable period the Projection Historical Committee has been working quietly and without any fanfare of publicity in collecting material to be used as a basis for a permanent history and record of the contribution to the motion picture industry by the projectionist craft.

The projection historical collection will contain articles, items and papers taken from journals issued by the various engineering and craft societies, and from trade and craft publications. A great deal of preliminary work is necessary in an undertaking of this kind as a tremendous amount of material gathered from various sources has to be carefully selected, read and condensed. In addition, the collection will contain statements by leaders in the motion picture industry paying tribute to the craft for its high standards.

When systematized and put into permanent form, it will serve as a basis for a history and record of what the projectionist has contributed to the technical progress of the motion picture industry. The practical value of some of this material has already been conclusively demonstrated.

Members of the Projection Historical Committee, acting largely in an advisory capacity, are Lester Isaac, Thad Barrows, J. Basson, Harry Rubin, P. A. McGuire, and Tom McNamara, secretary of the committee.

resistor and trace straight left and up to the plate of V-1. From the bottom of the dotted line resistor trace straight left and up to the cathode of V-1.

The plate circuit of the input tube is connected directly across the dotted resistor. Output speech voltage is being fed back to the input tube of the amplifier.

The reader can readily trace other lines through which the output voltage across the dotted line resistor can feed back into the amplifier.

Figure 3 is identical in every detail with Figure 2, except that decoupling resistors and condensers have been added. They are the parts shown in heavy black lines—one decoupling resistor in series with each plate supply, and one decoupling condenser shown under each tube.

Let us trace the output speech circuit in Figure 3 from the plate of V-3 down through the output resistor, then left through the decoupling condenser to cathode. A parallel current must flow through the dotted line resistor just the same—current facing two parallel paths will always divide inversely as the impedance of those paths—but the decoupling resistor still further increases the impedance of the path through the source of B supply. The values of the decoupling resistor and condenser are so chosen as to send most of the speech current back to cathode through the decoupling condenser, leaving very little to flow through the dotted line resistor.

Decoupling resistors and condensers are found in practically every modern amplifier. In Figure 3 they have been added to all three stages. This is usually done; in some amplifiers V-1 might not have them.

A short across a decoupling resistor, or an open in the line of decoupling condenser, may produce hum, or motorboating or howling, or all three. In such cases the remedy is obvious.

Hum—of line frequency—may also be created in an amplifier by any failure in its rectifier circuits, such as strong unbalance in the currents through full-wave rectifier tubes, deterioration of filter condensers, or a short across a filter coil. An emergency repair in such cases may be to ground the positive side of the output of the filter through a very large capacitance, something of the order of from five to fifty microfarads. Of course, the capacitors used must be capable of withstanding the peak output voltage of the rectifier.

In some amplifiers cores of power transformers of filter inductors have been known to loosen and vibrate under the magnetic influence of the current passing through their coils. Only one or a few laminations of the core may vibrate individually. Hum is almost certain to result. If the transformer or inductor assembly is of the nut-and-bolt type, tightening the bolts cures the trouble; and all such bolts should be subject to routine inspection and tightening at regularly scheduled intervals of not more than six months. C-clamps have been used with success on riveted cores.

Line frequency hum may be picked up by coupling transformers, particularly those that are followed by much amplification. The usual remedy is to rotate the transformer to a position of minimum pickup. Surrounding or partially surrounding the transformer with a shield made of several thicknesses of sheet iron has also given successful results.

Other Hum Causes

A voltage source supplying photocell, exciter lamp or speaker fields may, if a rectifier, give rise to hum through any of the faults mentioned above in connection with the rectifying circuits of an amplifier. Or, if the voltage source in question is a generator and not a rectifier, any fault in its commutator, grounding or output filter may cause hum. Pitted commutator, improperly seated or sticking brushes, deterioration of a filter capacitor, loose or corroded ground connection are among the commoner possibilities. Hum from these sources can readily be run down to its cause.

With the system turned on but no film running, successively cut off power to the exciter lamp, excitation to the photocell and field supply to the speakers. The hum will stop when the faulty supply circuit is opened. An emergency repair that will often be satisfactory may consist of grounding the ungrounded side of the supply line through a capacitor of suitable size and voltage rating. A capacitor of as little as 1 mfd. possibly may prove adequate for the PEC supply; while a very large capacitance may be needed for the speaker field supply.

The foregoing does not at all exhaust the possible causes of hum. As stated previously, the causes of hum are inexhaustible.

False Economy in Planning Time for Repairs a Common and Expensive Mistake

The mistaken policy of skimping on the time to make equipment repairs is an outstanding fault in many theatres, with resultant problems far outweighing another hour or two that should have been planned upon to take care of needed repair or maintenance work. Many unexpected delays often crop up, and thus there should be ample tolerances allowed to take care of them.

In dismantling and reassembling apparatus for the purpose of making repairs such delays always may be expected, and the fact that similar work was done in two hours previously does not mean that the job again can be accomplished in the same time. If a certain job is expected to take two hours and the show opens at 2 o'clock, the projectionists should be given more than two hours for its completion in order to assure that everything will be ready to start the show at the opening time.

One reason for this is that in the course of such work it may be found that the trouble actually is more extensive than had at first appeared to be the case. Again, some secondary difficulty may be encountered after the work is started. Further, the work of dismantling equipment may result in unavoidable damage to some part that had almost but not completely worn out. It also may be found that the trouble symptoms were misinterpreted, with entirely different handling necessary.

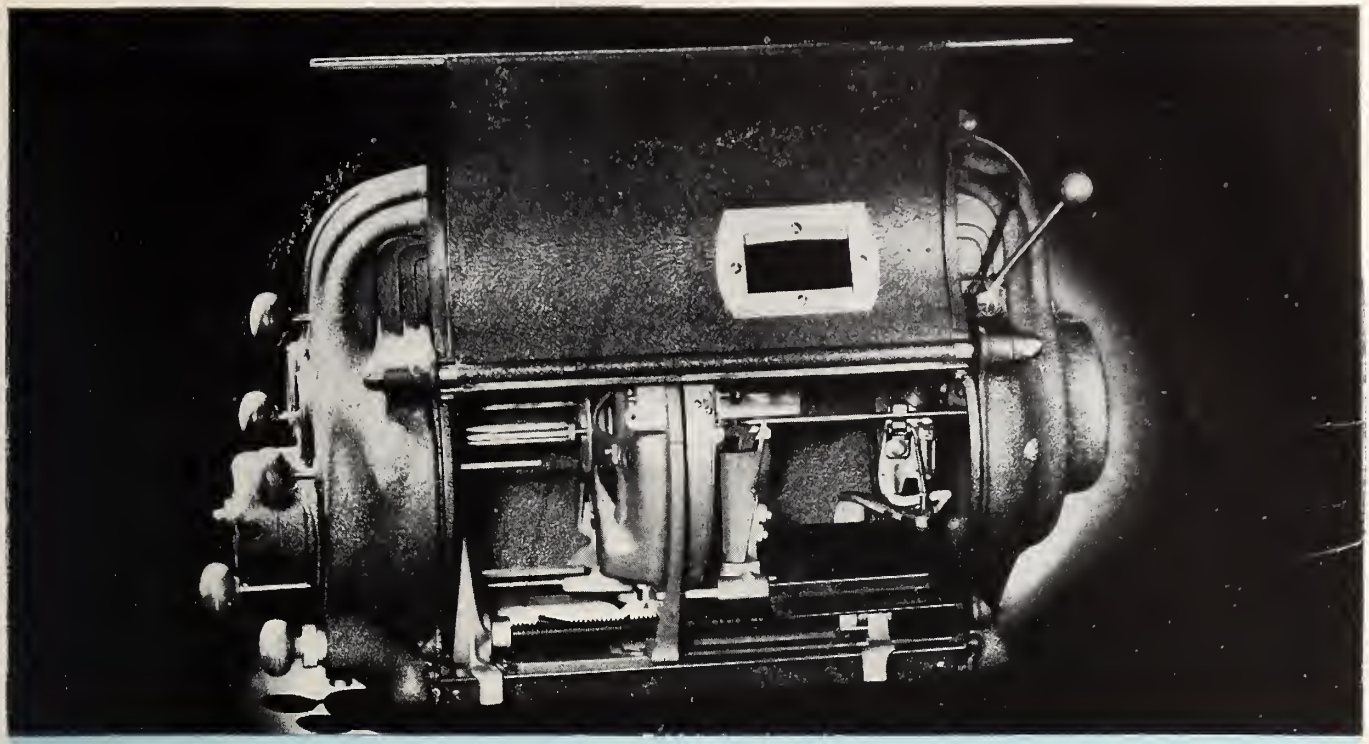
The old axiom that the "show must go on" holds in the movie theatre today, and any delay will react to the detriment of the house. So it can be seen that if repair work is to be done *previous* to the opening of a show sufficient time must be allowed for its full completion, even if it means that those doing the work will be idle even an hour or two before the show starts.

This is true because if difficulties are met with one of the three following things will happen: (1) the show will start late; (2) the work is rushed or poorly done, resulting in possible poor performance or future damage to equipment, or both, and (3) the show must be put on unsatisfactorily, on an emergency basis, resulting in additional work to be done after the final reel.

Experience has proven conclusively that it truly is poor economy to underestimate the time necessary to make repairs, and projectionists will protect their employers to the maximum extent if they insist that sufficient tolerance be allowed to assure that the show will open at the time scheduled.

WESTINGHOUSE TERMINATES LAMP LICENSE AGREEMENTS

According to an announcement by the Westinghouse Electric Corporation it has cancelled its lamp license agreements with the General Electric Company, effective as of Aug. 1, 1945. Ralph C. Stuart, vice-president in charge of the Westinghouse lamp division, Bloomfield, N. J., said the termination was effected by mutual agreement. Under terms of the dissolution each company has granted the other a non-exclusive and unrestricted license entitling each to use lamp patents owned and controlled by the other up to and including Aug. 1, 1945.



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They project twice as much light as is possible with low intensity lamps and with only little increase in cost.

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IN THE SPOTLIGHT



By *HARRY SHERMAN*

PECULIAR people, these exhibitors. When speaking of the "good old days," they invariably recall that in the early days of motion pictures—some 30-odd years ago—projectionists (or operators, as they were then called) were paid the munificent sum of $15 per week. They like to compare that figure with the present day salaries of projectionists and then sadly shake their heads in bewilderment as if to say "What is the industry coming to?" They fail to mention that in the days of $15 salaries the admission price to most "dumps" where pictures were shown was 5c, as compared with today's admission price of 65c and up for the average neighborhood theatre.

It would indeed by very interesting to compare the profits of the average theatre of the so-called good old days with the profits of today. It is very true that operating costs have increased considerably—but so have box office receipts. But that, of course, is a horse of another color. Box office receipts are discussed only when negotiating labor contracts with union officials, when Mr. Exhibitor dons his crying shawl and wails about "slumps," "depressions," and what have you.

● To William P. Covert, 2nd vice-president of the I. A., and business agent of Local No. 173, Toronto, Canada, goes the credit for the cleanup in the dual union situation that had existed in Winnipeg for the past ten years. He successfully concluded an amalgamation between the rump union, the O. B. U. (One Big Union) and the Winnipeg I. A. Local No. 299. The 31 members of the O. B. U. were admitted to membership in Local 299, and two of the former officers were appointed to the executive board, a move which harbors well for a harmonious future. This makes the province of Manitoba practically 100% unionized, and under the continued guidance and leadership of Covert, we feel certain that the Canadian I. A. locals soon will eliminate completely the evils of the dual unionism.

● We spent a delightful evening the other week with Bill Kunzmann, roving ambassador of goodwill for National Carbon; Herb Griffin, president of Librascope (subsidiary of International Projector Corp.), and Oscar Neu of Neumade Products. We had much to talk about and had many laughs recalling some of our youthful exploits. Needless to say, the combined age of this group hits well over the two century mark and we had plenty of territory to cover in our reminiscences.



Herb Griffin (Librascope), Bill Kunzman (National Carbon), and I. P.'s Harry Sherman about to partake of some light refreshments at their recent reunion in this city at Rogers' Corners. Herb and Harry smile their prettiest for the camera while Bill is a bit more serious.

● We were glad to learn that "Bucky," son of Francis P. McCoy, secretary of Local No. 444, New Kensington, Penna., has fully recovered from his recent operation. Dad McCoy is one of our regular correspondents and in one of his communications he informed us that he is a frustrated doctor. He started out in early life with the intention of studying medicine, but was sidetracked somewhere along the way and wound up as a projectionist.

● We have just learned via the grapevine that Thad Barrows, the popular president of Boston Local No. 182, has taken up tree-climbing as his latest vocation. Monkey shines, we call it.

● Our condolences to Mike Joseph, chairman of the executive board of Local No. 17, Louisville, Ky., on the recent death of his mother. Mike has been a delegate to a number of I. A. conventions and is very active in union affairs in the state of Kentucky.

● Last month we visited our good old friend, Abe Seligman, old-time member of Local No. 306, New York City, at the Will Rogers Sanitorium at Saranac Lake, N. Y. Abe, we are happy to report, is making excellent progress and is eagerly looking forward to the day when he will be discharged as completely cured of his ailment.

● The inclusion of a clause guaranteeing the payment of salaries to projectionists during the term of contract should be insisted upon by union officials when negotiating new contracts with theatres. Many theatres, particularly in small towns, are leased by their owners for meetings, social affairs, conventions, and other functions that do not require the showing of films and the services of projectionists. This means that despite a

union contract, a theatre may, if the owner chooses, dispense with the service of the projectionists by eliminating the showing of pictures and using his theatre for other purposes.

No, we are not off the beam when we make this statement for such a contract has been in existence in New York for many years. Under this contract home office projection rooms guarantee the pay of the regular projectionists for the duration of the contract—even if the projection room, for any reason, closes.

With television in the offing, there is a strong possibility that many theatre owners may decide to lease their theatres to other interests and so throw their projectionists out of work. It is against such a possibility that we must protect ourselves.

● We point with pride to the record of Lt. Col. John O. Aalberg, member of Chicago Local No. 110, and now staff officer in charge of all ground force photographic activities in the China-Burma-India theatre of war operations.



Lt. Col. Aalberg

Aalberg enlisted in the armed services in 1942 and was transferred to India in 1943, where he is still "sweating it out."

John Aalberg is an old line projectionist, having worked at the Bandbox Theatre in Chicago (now out of existence) back in 1921. Being an ambitious youngster, he studied engineering at the Armour Institute and received his degree in 1924. He left Chicago in 1927 to work for General Electric on the development of what later turned out to be the RCA sound system. He was sent to Hollywood in 1929 and in 1932 was appointed head of the sound department for the RKO studios, a position he held until his enlistment in the army and to which he will return upon his discharge.

Aalberg's duties overseas include the distribution and exhibition of 16-mm entertainment film over a circuit stretching from the Persian Gulf to miles north of Chungking. He often finds it necessary to travel over that route on a personal inspection tour, and no doubt will have many an interesting story to relate of his experiences in that part of the world. On his return to this country, he plans to stop at Chicago for a visit with some of his friends of the old days—Gene Atkinson, Ora Bebb, Jim Gorman, Clarence Jalas, and the rest of the Local 110 old-timers. Perhaps John will stop off at the offices of IP just to say hello—we will be very proud to shake his hand and say "Atta boy."

● Rev. Robert A. Boelcke, head of the Science Department at St. Mary's College, North East, Penna., and honorary member of the 25-30 Club, recently celebrated the 25th anniversary of his ordination to the priesthood. A celebration in honor of the event was held at the college and was attended by many relatives and friends of the priest.



Father Boelcke

As head of the Science Department of St. Mary's, Father Boelcke, who is an advocate of visual education, introduced motion pictures in the classrooms of the college. He is no novice in the projection field, having been interested in this work since 1916 and holds a Class A projectionist's license in the state of Pennsylvania. He is very proficient in the art of projection and can hold his own with any professional projectionist we know. He is interested in all phases of the art, and we hope, in the near future, to prevail upon Father Boelcke to write an article on the subject for the readers of this publication.

● Arthur Milligan, president, and William P. Covert, business agent of Toronto Local No. 173, are now in the midst of negotiations with the exhibitors for new contracts. The union officials have presented their demands to all exhibitors in their jurisdiction — circuits, subcircuits, and independents—and, like their progressive brothers in this country, are demanding for their members conditions that have long been in practice in every industry but ours. The local is asking for a 35% increase in the basic wage scale, time and a half for statutory holidays, double time for midnight shows, two weeks vacations with pay, and pay for preparatory time. In addition, the local wants a $2,000 insurance policy for each member who has been employed for three years or more. The projectionist has long been the forgotten man of the theatrical industry and it is high time our craft receives some of the benefits given workers in other fields for faithful and loyal service.

● Al Malley, press secretary for Los Angeles Local No. 150, is the proud dad of a pilot-bomber now engaged in the Pacific theatre of war. May he come home safely with the rest of our boys.

● Paramount-Richards Theatres, Inc. (La.) have been permanently enjoined by the Federal Court for violation of the wage and hour act. It was charged that wages paid to 49 employes were less than those stipulated by law, and that employes worked overtime without time-and-a-half pay. It was also claimed that the firm did not keep accurate records.

● Charlie Brunner, 4th District secretary, is making rapid strides in his recovery from a recent serious operation. Charlie is also secretary of Local No. 130, Altoona, Penna., and is a member of the nationally known 25-30 Club.

● The War Committee on Conventions of the Office of Defense Transportation rejected the application of the American Federation of Labor to hold its 1945 convention. The executive council of the Federation, however, held its annual session in Chicago early this month.

● Two of the most popular I. A. union officials in New York City were re-elected to office sans opposition. We refer, of course, to Jimmy Murphy, president, and Maurie Seamon, business agent—secretary of the Treasurers and Ticket Sellers Local No. 751. These men have consistently held office in the local since it received its I. A. charter in 1938.



Maurie Seamon

The Murphy-Seamon team is an example of smooth working and harmonious relationship between union officials, and under its leadership the members of Local 751 have received several salary increases and more favorable working conditions. Not only are these men very able and conscientious union officials, but they are pretty swell and regular guys.

● We regretfully report the death of Lafayette (Lafe) Wareham, former vice-president of Local No. 386, Columbus, Ohio. Until stricken with the illness that later caused his death, Lafe took an active interest in Local 386 affairs. Our friendship began about twenty-five years ago when yours truly was an I. A. representative and was sent to Columbus to straighten out certain local matters, and continued until his passing. We extend our deepest sympathy to his survivors.

MAJ. HUNT IS NAMED ALTEC INSPECTOR

Major James W. Hunt has been appointed Altec Service Corporation's inspector with headquarters in Waco, Tex., it is announced by C. J. Zern, Dallas district manager. Major Hunt, who was released recently from the Radio Teletype Section, Communications Wing of the Army Airways Communications Systems, will devote his time to improving s und reproducing equipment performance in theatres in Texas.

Projectionists' Course on Basic Radio and Television

By *M. BERINSKY, E. E.*
MEMBER OF INSTITUTE OF RADIO ENGINEERS

XIV—CAPACITANCE

CAPACITANCE, which is manufactured commercially and is known as a condenser, is equally important in radio as inductance. Not all capacitance, however, is found in the form of commercial units; sometimes it exists between certain radio components. More often than not such capacitance results in poor performance in a radio receiver and steps are taken to eliminate or reduce it. Capacitance of this kind is known as stray capacitance.

Whenever two conductors of electricity are separated by an insulator a condenser is created. The insulator in a condenser is often called a dielectric. The dielectric may be a vacuum, air, glass, mica, waxed paper, oil, ceramics, or a chemical deposit such as aluminum oxide. The conductor is usually constructed of steel, aluminum, tin foil, brass, or metallic paint.

Condenser types usually are designated with respect to the kind of dielectric that they contain. For example, a paper condenser contains a paper dielectric, and a mica condenser contains a sheet of mica as the dielectric.

Condenser Action

The action of a condenser will now be explained. Let us suppose that a condenser is connected, as shown in Figure 1. This is a series circuit consisting of a condenser, a battery, a zero center scale galvanometer which reads to the right or left, depending upon the direction of current through the meter (similar to an ammeter in an automobile), and a switch.

When the switch is open the condenser does not have any charge on it, and when the condenser is not charged it is said to be in a neutral state. At the instant that the switch is closed electrons rush from the upper plate of the condenser into the positive terminal of the battery. It should be remembered that a battery is a source of electrical pressure and is capable of forcing free electrons to move. The positive terminal of the battery is deficient in electrons. When it is connected to the condenser it will draw some free electrons from the plate of the condenser to which it is connected.

The negative terminal of the battery has an excess of electrons. These excess electrons will now move into the lower plate of the condenser because this plate is connected to the negative terminal of the battery. The direction of electron flow is indicated by the arrows in Figure 1, and because electrons flow through the galvanometer it will give an indication.

The atoms which make up the condenser have been disturbed from their neutral condition due to the transfer of electrons from one of the plates to the other. This disturbance will create lines of electrostatic force between the plates of the condenser, and these lines of force result in a dielectric field between the plates.

All condensers are capable of storing a certain amount of electrical energy (dielectric field) depending upon their capacity (size). When the condenser in Figure 1 has stored all the energy of which it is capable, the electrons in the circuit will cease to flow. The condenser is then charged to the same voltage as the battery and the circuit is similar to one which contains two batteries of equal voltage in parallel. In practice it takes only a fraction of a second to charge a condenser to the voltage of the charging source.

Because the flow of electrons is only in evidence for a very short period of time, the galvanometer will act in the following manner. At the instant the switch is closed the needle of the meter will kick to the right and then return to zero. This indicates that the current in the circuit flows for only a very short period. If the battery were now removed from the circuit the dielectric field would still remain. Theoretically, the field should remain indefinitely if the condenser is not disturbed. In practice, however, the field deteriorates rapidly when the battery is disconnected because the electrons which have left the upper plate of the condenser desire to return to it and will do so by leakage through the dielectric or through the air.

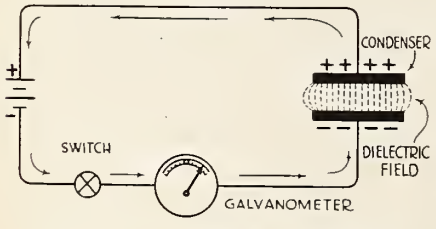


FIGURE 1. *Charging a condenser.*

Effect of Closed Switch

Figure 2 is very much like Figure 1 except that now the battery has been removed from the circuit. When the switch is open the dielectric field still exists between the plates of the condenser. Let us suppose that the switch in Figure 2 is closed. The electrons from the lower plate of the condenser will now return to the upper plate from which they came originally. The direction of current in the circuit has now reversed from that in Figure 1 and the meter will kick to the left and then return to zero when all of the electrons have returned to the upper plate. The condenser is now said to be discharged and the dielectric field will disappear completely. Although the electrons have moved in the circuit, none have actually passed through the condenser because the plates of the condenser are separated by an insulator and the electrons can not move through an insulator.

When direct current is impressed upon a condenser, current flows in the circuit for only a fraction of a second and then becomes zero. Because current flows for only a fraction of a second it is said that direct current does not allow current to

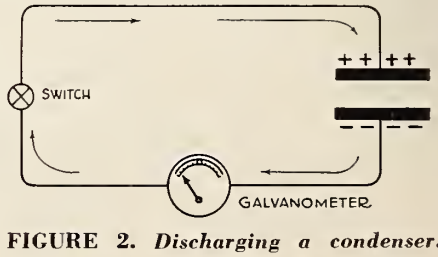


FIGURE 2. *Discharging a condenser.*

flow in any circuit which contains a condenser. As we shall see a little later, alternating current will allow current to flow in a circuit that contains a condenser.

A condenser is very useful in radio circuits for separating direct currents from alternating currents. A condenser has a smoothing effect when placed across a direct current that is varying slightly in amplitude (pulsating direct current) and these condensers are commonly used in the power supply section of radio receivers. In this application, they are known as filter condensers.

When an exciter lamp in a motion picture projector is operated from rectified alternating current, a great deal of filtering is necessary in order to remove the 60 cycle hum which would show up in the sound. Large condensers are used for this purpose. Whenever circuits which contain a large amount of inductance are opened, a great deal of sparking results at the switch contacts. This is true of direct current circuits which feed motors, generators, spark coils, relays, and automobile ignition systems.

Since inductance tends to keep the current flowing when the switch is opened, a hot spot develops on the switch contacts. This hot spot burns the contacts and carries away from them small particles of copper. This action results in premature wear on the switch and lowers its efficiency as a switch because of pitted contacts. If a condenser is placed across the switch contacts the condition is soon remedied. The reason for this is that the energy set flowing by the inductance in the circuit charges the condenser and eliminates sparking.

Storage of Energy in a Condenser

The amount of energy that the dielectric field of a condenser can store depends upon the size of the condenser—the larger the condenser, the greater the energy.

TABLE OF DIELECTRIC CONSTANTS

The following is a table of approximate dielectric constants for some materials that are commonly used as insulators in condensers.

Celluloid, photographic film	6.7
Cellulose nitrate	3.8
Fiber	4.8
Fused quartz	4.0
Glass	6.5
Pyrex	4.9
Hard rubber	3.0
Isolantite	6.1
Mica, India	6.0 to 8.69
Paper	2.6
Polystyrene	2.6
Porcelain	7.0
Wood	2.5 to 6.8

The size of a condenser depends upon four factors: (1) *the area of the plates facing each other;* (2) *the number of plates that are connected in parallel;* (3) *the distance between the plates or the thickness of the dielectric, and* (4) *the type of dielectric used.*

If the quantities in the first and second factors listed are increased, the capacitance of the condenser will increase as will its ability to store energy. If the distance between the plates were increased, the capacitance would decrease because the concentration of the dielectric field would be less dense.

The type of dielectric used in a condenser is very important in determining its size. The atomic structure of some dielectrics is such that they aid the dielectric field more than others when an electrical pressure acts upon them. This quality has been designated as the dielectric constant. The dielectric constant of air is 1, and the dielectric constants of other materials differ widely. Mica, for example, has a dielectric constant of approximately 6. Let us see what significance this has. It means that if an air condenser has a certain capacitance and if mica were substituted for air, the capacitance of the condenser would increase six times.

Dielectric Strength

The dielectric strength of an insulating material is the minimum value of electric field intensity required to rupture it. Dielectric strength usually is expressed in kilovolts per centimeter of dielectric thickness. Heating of the dielectric leads to rapid deterioration, particularly if moisture is present, and ultimate breakdown. Most dielectrics will withstand a much higher voltage for a very brief period than voltage applied for a longer period. These effects have dictated two tests for condensers, a high flash-test voltage of very brief duration, and the application of a much lower voltage for a longer period.

If too large a voltage is impressed upon a condenser its dielectric may be pierced by a spark which jumps through it. In condensers using paper, mica, or glass as the dielectric, the puncture of the dielectric by too great a voltage will prove fatal and will render the condenser useless for radio work. A condenser using oil, a wet electrolyte (borax solution), or air, will heal itself after the excessive voltage is removed. This excessive voltage is known as the "breakdown voltage." Condensers should never be operated with such a high voltage across them. The safe voltage which may be impressed across a condenser is called the "working voltage." Lower voltages may be used, but voltages higher than the working voltage should never be used for more than a brief period.

JULY QUESTIONS AND CORRECT ANSWERS

1. **(Q.) Find the resistance of a 2-henry choke connected across 100 volts, 60 cycles.** ***(A.) 753.6 ohms.***
2. **(Q.) Find the current that will flow through the coil.** ***(A.) .13 amps.***
3. **(Q.) Find the reactance of a 50 micro-henry coil connected across one volt at 200 kilocycles.** ***(A.) 62.8.***
4. **(Q.) A reactance of 3 ohms and a 5-ohm resistor are connected in series. Find the impedance.** ***(A.) 5.8 ohms.***

A condenser can be made to withstand very high voltages by increasing the thickness of the dielectric, but this is not always feasible because the capacitance of the condenser decreases as the thickness of the dielectric increases. In order to make up for the loss in capacitance it would be necessary to increase to area of the plates, thereby making a very bulky condenser.

Mica condensers of this type have been used recently in some radar equipment. They were about ten times larger than ordinary "postage stamp" mica condensers and were capable of withstanding from 2,500 to 5,000 volts.

The amount of voltage that a condenser can safely withstand is clearly marked on the condenser. These voltage ratings vary for different kinds of condensers—for mica condensers the values range from 500 to 5,000 volts; for paper condensers from 150 to 2,500 volts, and for electrolytics from 25 to 600 volts.

Rating Condensers

The size of a condenser is known as its capacitance, and the unit of capacitance is the "farad," named so in honor of the English scientist, Michael Faraday. This unit is much too large for practical work. In practical work the micro-farad (one millionth of a farad) and the micro-microfarad also called the pica-farad (one millionth of one millionth farad) are used. The farad is the amount of capacitance present when one coulomb of energy is stored in a dielectric field under a pressure of one volt. Paper and electrolytic condensers usually are rated in micro-farads, while mica condensers are rated in micro-microfarads. The electrical symbol for the micro-farad is μfd. and the symbol for micro-microfarad is $\mu\mu$fd. The Greek letter μ (Mu) is used to represent the word micro.

Some manufacturers use the letter m in place of the Greek letter μ, so that micro-farad would be written mfd. and the micro-microfarad would be written mmfd. Sometimes the d in mfd or mmfd is omitted. Electrolytic condensers usu-

ally are from 4 mfds up; paper condensers are from .001 mfd (1.000 mmfd) to 5 mfds; and mica condensers run from 1 mmfd (.000001 mfd) up to 1,000 mmfd (.001). The size is clearly stamped on paper and electrolytic condensers, and on mica condensers the size is sometimes stamped but more often it appears by means of a color code which has become standard for the industry.

The capacitance of a parallel plate condenser may be calculated by the following formula:

$$C = \frac{0.0885 \times K \times A \times (N-1)}{t}.$$

Where C is the capacitance of the condenser in micro-microfarads, K is the dielectric constant of the insulator between the plates, A is the area of one plate in square centimeters, N is the total number of plates, and t is the distance between the plates or thickness of the dielectric in centimeters.

Construction of Condensers

One of the most common of commercial condensers is the variable air type. This is the device you turn when you tune in a station on your receiver. The variable condenser consists of two sections of brass or aluminum plates, one set being free to turn and called the rotor, and the other set being fixed and called the stator. When the rotor is turned the effective area of the condenser plates is changed, and this varies the capacitance. For this reason the condenser is known as a variable condenser.

Condensers whose capacitance can not be varied at will are known as fixed condensers. A mica condenser falls under this type. This condenser consists of several plates of steel, brass, tin foil, or aluminum, each set of plates being separated by a sheet of India mica. Each alternate set of plates is connected together and two leads are brought out from the condenser. The metal and mica combination is then molded in bakelite or some other type of moisture-proof binder.

Some mica condensers are variable and are known as trimmers or padders. These condensers are not enclosed in a molded binder, and have instead a little set screw running through the plates, but insulated from them. Changing the setting of the screw brings the plates closer, or further apart, thereby changing the capacitance.

Trimmers vary in size from 5 to 50 mmfd and padders run up to around 250 mmfd. Paper condensers consist of two plates of tin foil separated by waxed paper. In order to obtain a great deal of capacitance in a small space the tin foil and paper are rolled up and the resulting condenser is incased in a jacket of cardboard. Two leads are brought out —one from each plate. The ends of the condenser are covered with sealing wax to keep out dirt and moisture.

The paper dielectric is usually made up from several separate sheets of very thin waxed paper instead of just one sheet of proper thickness. This type of construction minimizes the chances for voltage breakdown.

There are two types of electrolytic condensers—wet and dry. One plate of loosely rolled aluminum which is immersed in an electrolytic solution, such as borax, is found in the wet electrolytic condenser. After a few seconds use, a thin film of aluminum oxide, and insulator, forms on the aluminum plate and acts as the dielectric. The container, which is usually made of zinc and forms a housing for the solution, forms the other plate. The aluminum is carefully insulated from the container by a strip of celluloid.

This condenser must be mounted in an upright position because of the danger of spilling the solution. Electrolytic condensers have polarity, the aluminum plate being positive and the zinc container being negative.

The condenser will be ruined if it is not connected in accordance with the polarity which is clearly marked or color-coded. Wet condensers can stand up under severe overloads and are self-healing after a temporary breakdown. The dry electrolytic condenser contains an electrolyte in the form of a paste and may be mounted in any position because it can not spill. Dry electrolytics are not self-healing and must be discarded after a breakdown.

The electrolytic condenser is widely used on direct or pulsating direct currents because it contains a large amount of capacitance in a very small space. The reason for this is because the dielectric film is very thin, only a few thousandths of an inch. Dry electrolytics are usually made up in multiple sections containing as many as five condensers in one container. The negative terminal usually is common for all sections.

Electrolytic condensers of the type mentioned above can not be used on alternating currents.

Increased Theatre Service Needs Stressed at Recent RCA Conference

At the recent ten-day conference of RCA Service Company officials and district managers held at the Seaview Country Club, Absecon, N. J., plans for improving and expanding its services in the motion picture field was one of the principal topics of discussion. E. C. Cahill, president of the Service Company, and W. L. Jones, general manager, declared at the opening sessions that a major portion of the post-war planning of their organization has been directed toward service operations in the motion picture industry. They declared, in looking forward to equipment improvements; that the highest technical proficiency would be more than ever required, directed toward helping the exhibitor keep his equipment operating at maximum efficiency.

Homer B. Snook, manager of the RCA Victor Division's Theatre Equipment Section, outlined his organization's plans for future sales activities. It also was announced at the theatre discussion period that demands from exhibitors and projectionists for "RCA Theatre Handbook for Projectionists" and "RCA Theatre Television Handbook" had exceeded all expectations.

Other activities discussed included the government group, primarily engaged in providing field engineering service on radar and other electronic equipment installations for the armed services; the industrial group, which handles electronic power generators, plant sound systems, and the electronic microscope; and the radio and television group, which covers installation and service for home radio and television receivers.

J. G. Wilson, newly appointed operating vice-president of the RCA Victor Division, addressed the service managers, stressing the importance of the service organization's operations in keeping RCA equipment users satisfied, through service, after the sale of the product had been completed.

District managers at the conclusion of the sessions, spent a day at the RCA Research Laboratories at Princeton, N. J. Various talks and demonstrations acquainted them with electronic research progress in several fields.

Frank M. Folsom, RCA executive vice-president, in charge of the RCA Victor Division, was the principal speaker at a dinner meeting held at the Ritz Carlton Hotel, Philadelphia.

AUGUST QUESTION

1. A parallel plate condenser has 4 plates, each one having an area of 600 square centimeters, and its dielectric has a constant of 5. The thickness of the dielectric is .25 centimeters. Find the capacitance of the condenser in mmfds.

The correct answer to this question will appear in the next issue.

AT YOUR SERVICE

This department is a collection of random thoughts and some not so random: fact, fancy and opinion relating to the man behind the man behind the gun—the serviceman. The prime purpose of this section is to promote a closer relationship between serviceman and projectionist based on a better understanding of their mutual problems through an exchange of news and views, kinks and kicks. To this end, contributions relative to any phase of the serviceman's activities are invited.

Breaking in Overhauled Projectors

This item should be of particular interest to projectionists. Many theatres are now having their projector heads overhauled and repaired without proper running in time. As a result, the projectors bind up within a short time after being repaired.

At one of the theatres I serviced, I happened to notice that the projectors were operating very smoothly and both projectors felt the same when turned over by hand. This is most unusual as in most cases the intermittent load on the projector varies considerably from projector to projector. I mentioned this to one of the projectionists and he told me that he mixes one quart of Mystery Oil, a lubricant which can be purchased at most supply stores, with each quart of regular projector lubricating oil. By using this lubricating mixture whenever necessary, this projectionist has never had a projector bind up while running.—Monore Levy, *RCA*.

Proper Use of Measuring Instruments

Because meters are very difficult to obtain and, as a general rule, are pretty expensive, the following hints on the use of test instruments will be worth noting.

1. *Overload.* Always select a range to be used. Double check before using the probes for each time an instrument is overloaded there is a likelihood that the heat will dissipate in the coil and cause the wire to swell, which eventually would drag against the pole pieces causing a "sticky" meter.

2. *Dropping.* Always place instruments on something firm and close to your work. When making a frequency run the leads to the output meter should be tied around the rewind or some other solid object to prevent the meter from being dropped to the floor.

3. *Inaccuracies.* Never place an instrument on the top of a generator, power transformer, or any vibrating body, as they will cause the magnet in the instrument to lose its magnetism and result in a "low" meter reading.

4. *Sticky Meter.* Always place your test set upside down, preferably well back on the seat of the car. Vibration will "mushroom" the tips of the delicate pivots in your meter and will cause friction. In placing it upside down, the weight of the coil is upon the little used top pivot and jewel.

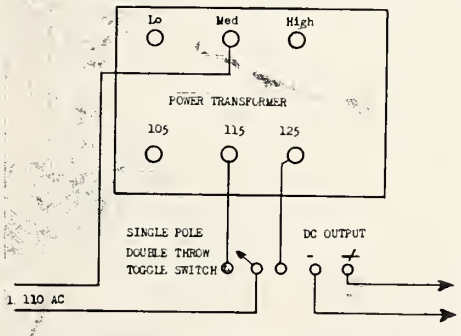
5. Refrain where possible from taking instruments into the projection room where there has been a film fire, as the fumes have a corrosive effect upon delicate instruments. The coil in a 50 microampere meter usually is wound with No. 46 or finer wire.—Frank Ingels, *RCA*.

Prolonging Life of Cables Leading to Lamphouse

A coat of air drying insulating varnish (obtainable at most electric motor repair shops) applied to the asbestos covered cables inside and/or leading to the lamphouse, will greatly prolong their usefulness. The varnish forms a smooth, comparatively hard outer coating on the cable and prevents the asbestos covering from fraying and peeling due to the abrasion of brushes or rags used in cleaning the lamphouse, and yet allows the cable to retain sufficient flexibility.—G. R. Mann, *Princess Theatre, Urbana, Ill.*

A Simple Switching Arrangement for Line Voltage Fluctuation

Where the 110-volt a.c. line voltage fluctuated considerably, a single pole double throw toggle switch installed as shown in the diagram below resulted in



better operation, especially where the a.c. line voltage drop caused the relay to be inoperative.—G. E. Reiger, *RCA*.

Lubricating Remote Volume Control Motor Used on PG-30 Series Systems

By filing a small round hole in the bottom edge of the protective metal covers of the PB-23 amplifier and opposite the back end of the remote control motor shaft, the latter can be lubricated without removing the cover. This speeds up lubrication which can be done while the system is in use. Without this notch, the tubes have to be removed first and then the metal plate.—R. H. Bisbee, *RCA*.

Correcting Cracking Sound Effects in W. E. 91B Amplifier

Intermittent crackling sound effects which may be mistaken for failing electrolytic capacitors have been overcome by grounding the BX leading from the 101 connector unit to the main amplifier. Usually these troubles appear when the service engineer is away from the theatre, therefore it becomes difficult to trace the source of trouble.—Leo Cimikowski, *RCA*.

Precaution in Using Carbona

Just a word of caution to those who use Carbona in their service work. I recently purchased a bottle of this cleaning fluid and noticing that its odor was different than usual. I investigated and found upon reading the label that it was inflammable. The label and all appeared just the same as the old non-inflammable kind, and I suggest that it will pay to read the label before buying this cleaning fluid.—A. H. Clow, *RCA*.

More 16-mm Service Tips

Here are additional tips on servicing 16-mm apparatus:

1. Some 16-mm speakers have two field windings—one of 4,000 ohms and one of 19,000 ohms. PM speakers can be substituted only if a 4,000 ohm 10-watt resistor is substituted for the 4,000 ohm field winding, because this winding supplies the exciter lamp. In case the 4,000 ohm speaker winding should burn out, a 4,000 ohm 10-watt resistor can be utilized to keep the exciter lamp going. The 19,000 ohm winding alone will supply sufficient emergency excitation for the speaker.

2. In the Bell and Howell Model V volume can be increased (at some sacrifice in quality) by open circuiting the 5,600 ohm inverse feedback resistor. This will be found on the resistor board strip of the amplifier chassis. Instead of re-

(*Continued on page* 28)

OLD SI AIN'T DOWN ON THE FARM ANY MORE

It's no longer "by guess and by gosh" on the farm. The modern farmer depends on muscle and gray matter. And no matter what the problem, he sees his production job through.

The Altec Service Engineer, too, does his job scientifically and efficiently. The audience up front doesn't know that behind each uninterrupted performance is the constant watchful care and expert attention given to sound and projection equipment by the Altec Engineer...and that backing him up is a vast organization of experts. Our interests are the same as those of the projectionist — uninterrupted service to the public.



ALTEC
SERVICE CORPORATION
250 WEST 57TH ST.
NEW YORK 19, N. Y.

PARTNERS IN PUBLIC SERVICE



Lightweight Soldering Iron For Hard-to-Reach Places

A small lightweight quick-heating soldering iron for use in instrument repair work of a delicate nature has been developed in an overseas Signal Corps repair shop.

The main advantages of the irons are light weight and quick heating. They can be brought from cold to effective heat in 45 seconds. The smallness of the irons makes it possible to reach hard-to-get places, and to perform delicate soldering jobs in meters. There is enough heat retention to achieve good results.

The heater assembly consists of a transformer having an output of 6 to 12 volts, with a current capacity of 10 to 30 amperes. The power source can be 110 or 220 volts, depending upon the transformer available. Two carbon electrodes are used, and these can be obtained from a standard BA-30 flashlight cell. A suitable fuse is placed in the primary circuit of the transformer for protection against accidental shorting of the secondary.

The basic principles of operation are that with the soldering iron tip inserted between the two carbon rods a current is permitted to flow in the secondary circuit. At the point of contact between the soldering iron tip and the carbon rods a high resistance contact results forming a small electric arc. The heat developed at these points of contact heats the iron.

NEW BOOK COVERS WIDE FIELD IN TELEVISION

"Television Programming and Production," by Richard Hubbell ($3.00), published by Murray Hill Books, Inc., 232 Madison Avenue, New York 16, N. Y., should be of vital interest to everyone looking forward to television and its post-war future. It should appeal particularly to those contemplating television as a possible future profession because it not only reviews studio techniques now in use but anticipates advances in equipment and methods.

Mr. Hubbell was a member of the original CBS television staff. As a former movie director the studio end of television naturally appealed especially to him, as did the economic possibilities of this new medium. Having garnered much first hand experience in the field he established practice as a television consultant, and at present is production manager and television consultant for the Crosley Corporation, broadcasting division.

In his book he carries the reader through the progress of television during the pre-war period, and through its advances to early 1945. Next are taken up the potentialities of the art in a discussion of television vs. other individual media of entertainment, and from this point on attention is centered on programming and production. Fifty selected photographs illustrate various types of productions and production problems.

W. E. DECLARES DIVIDEND

A dividend of 50 cents per share on common stock of Western Electric was declared at a meeting of the board of directors on June 12. The dividend was payable June 29, 1945, to stock of record at the close of business on June 22, 1945.

First-Aid Treatment of Burns and Scalds

There is no agreed policy with regard to the initial treatment of burns. Owing to the natural urge on the part of the injured person or his friends to do something (however ill-advised), it has been found that about 75 per cent of patients arrive at a hospital with some kind of application to the burned area—olive oil, carron oil, flour, coagulant jellies, cold tea, sodium bicarbonate, an "ointment" or flavine, etc.—often covered with a dirty, or at least a non-sterile, piece of cloth. Frequently, pain has not been relieved by these applications—sometimes it has been increased, and the difficulty of removal of the semi-coagulated jelly, of the oil or caked flour may well augment considerably the original trauma suffered by the burned tissues, thereby favoring the development of "shock." First-aid remedies of this kind especially if applied as they usually are without aseptic precautions, may well do much more harm than good.

The avoidance of infection by hæmolytic streptococcus should dominate first-aid policy for all but very severe burns. In the latter, measures for the preservation of life will often have to take precedence over local treatment of the burns.

For most small burns which are accessible, e.g., of the hand or forearm or head, first aid at the scene of the accident should usually be limited to covering the injured skin with a recently laundered clean towel, or, better, if it is available, with a sterile cloth. (Wherever burns are likely to occur, such cloths should be kept ready, previously sterilized in an oven and stored in a tin.) With the burn thus covered, the patient should be sent at once to the factory "surgery," or to a hospital or a private doctor.

In all severe or extensive burns, no first-aid should be attempted other than keeping the patient warm and giving morphine if required. Immediate removal to hospital is the first consideration.

When quite superficial small burns are treated at home or when, in the case of more severe burns, the plenary treatment cannot be carried out without considerable delay, it is recommended that the burned area and the skin around should be freely smeared with a water-soluble cream containing 1 per cent of cetyl trimethyl ammonium bromide and 3 per cent of sulphanilamide. This cream should be applied with a knife blade or spoon, previously sterilized by dipping for two minutes in boiling water. *The burn should not be washed before the cream is applied, nor should blisters be snipped.*

This first-aid treatment must be carried out with due precautions against the transfer of streptococci to the burned surface. Thus the operator's hands must be thoroughly washed and dried, and he should wear a gauze mask or clean handkerchief over his mouth and nose.

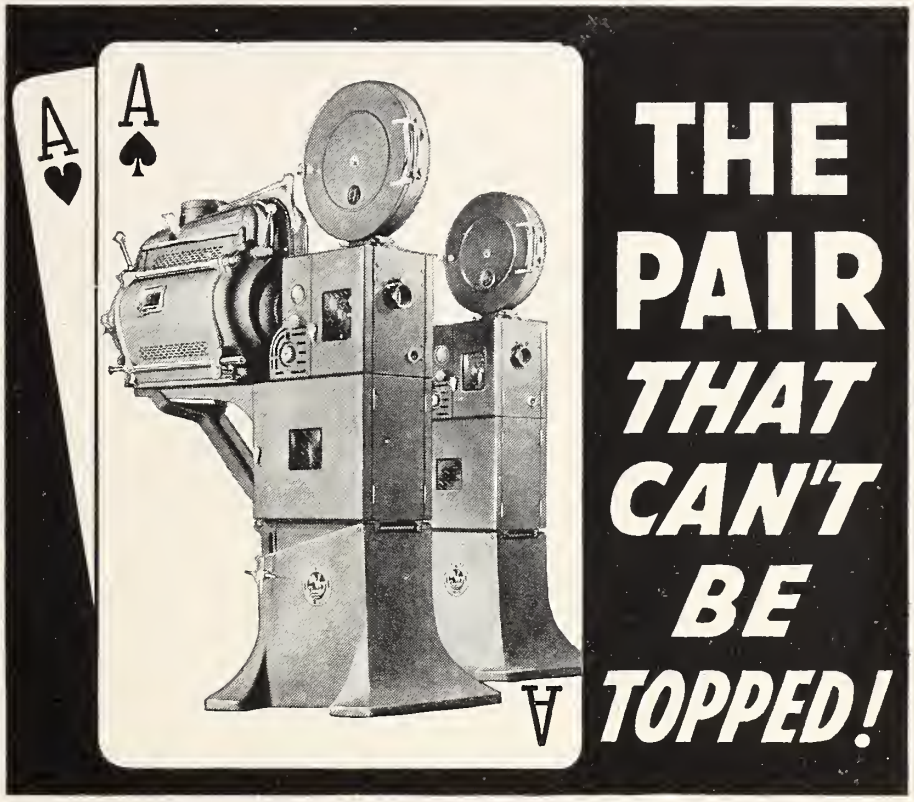
After being smeared with the cream, the burn should be carefully wrapped in sterile lint and a bandage, or in a recently laundered clean towel.

On no account should blankets be allowed to come into direct contact with the burn because they are often heavily contaminated with pathogenic organisms.

The cream should not as a rule be left on the burn for more than two days, as there is a slight risk of its inducing a dermatitis if left longer.

In special cases—e.g., in a small ship, or in shipwrecked persons—this small risk will be of no account in comparison with the much greater risk of infection if the burn is not treated.

The inclusion of a local analgesic in the first-aid cream is not recommended—for the following reasons: (1) It is unlikely to give sufficient relief for the pain of a severe burn, which will usually require morphine; (2) the pain of many small burns is so transient as to need no analgesic; (3) relief of pain by local analgesics is at best uncertain, and often short-lived, and (4) there is some risk of toxic effect from the use of local analgesics on a large burned area in susceptible individuals.



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John G. Bradley Heads New Motion Picture Project of the Library of Congress

John G. Bradley, chief of the Division of Motion Picture and Sound Recordings in the National Archives, has been appointed director of the new Motion Picture Project of the Library of Congress, according to an announcement by Luther Evans, Librarian of Congress. Through his years of research and experiment Mr. Bradley, as an acknowledged leader in the field of film preservation, has assisted many institutions in planning their preservation and storage techniques. Among these are the British Film Institute, the Canadian Film Board, the Union of South Africa, and the Australian Commonwealth. His film storage cabinet, patented under government auspices and tested at the Bureau of Standards, has received wide approval, including that of the SMPE.

Mr. Bradley's release by the National Archives to the Library of Congress emphasizes the cooperation envisioned between these two agencies under which his counsel also will be available to other government agencies interested in the preservation of film.

Dr. Evans stated that "photographic records in general and motion pictures in particular are playing an increasingly important role in goveranment, industry, science, education and cultural activities. Being a universal language their potentialities for service and international good will are beyond our present ability to judge. It is hoped that the Library's plans to expand into this new field of activity will be welcomed by its many friends and that Mr. Bradley will continue to receive the cooperation of those who have, jointly with him, brought this project to its present status.

"The appointment of Mr. Bradley to this position represents an important step in plans that were inaugurated in 1942 when an agreement was entered into with motion picture producers to deposit certain copyrighted films in the Library of Congress. This project took on added meaning when the Librarian of Congress and the Archivist of the United States received a joint directive from President Roosevelt in 1943 to draw up plans for a film servicing building and vaults for photographic materials in Government custody including copyrighted and other films acquired by the Library.

"The President's directive was based on the pressing need for additional storage and technical facilities to insure against loss of the pictorial evidence covering this important era in our national history."

Legislation to support the Library's plans has already been placed before Congress in the Lanham Bill (H. R. 1275), on which hearings have not been held to date. In the formulation of these plans Mr. Bradley acted as consultant to the Librarian, the Archivist, the Commissioner of Public Buildings, and others concerned. His qualifications in this respect are significant.

As head of the motion picture activities for the National Archives for more than ten years Mr. Bradley coordinated an original research project on the stability of film. This project was conducted at the National Bureau of Standards under the auspices of the National Research Council with the Society of Motion Picture Engineers Committee on Preservation of Film (of which Mr. Bradley has been Chairman for the last eight years) acting as a sort of reviewing board.

The membership of this committee includes representatives from the three major film manufacturing companies, the Will Hays Office, the Academy of Motion Picture Arts and Sciences, the Museum of Modern Art Film Library, and various Government motion picture engineers. The findings of the Bureau of Standards, therefore, under such auspices, should give substance of a national character to the film preservation practices that will be observed by the Library under Mr. Bradley's guidance.



LETTERS TO THE EDITOR

Projection in New Zealand

To the Editor of I. P.:

I have just been transferred to the "Reserve" after 32 months in the Royal New Zealand Air Force and am enclosing my change of address.

I must express my appreciation of the articles and information contained in I. P. and was particularly interested in the article dealing with "Motion Picture Projection The Navy Way" which contrasts sharply with conditions on most R. N. Z. A. F. stations where the projection equipment is, as a general rule, antiquated and in most cases has seen long service in theatres before the war. The running of the shows and booking of film is in charge of the Canteen Board—who also own the projection equipment.

As for myself, prior to entering the armed forces I was chief projectionist for about six years at one of the local theatres. I joined the R. N. Z. A. F. as a machine tool setter and operator, and in my spare time in the evenings I acted in the capacity of projectionist.

It may be of interest to you to know that as far as the "city" theatres out here are concerned, Simplex and Ernemann projectors are in the majority, with a sprinkling of Powers. Motiograph, Kalee, and several other makes. Sound systems range from WE Mirrophonic and RCA to many New Zealand made jobs, some quite good and others—well, just sound systems. Suprex Arcs were coming into their own over here prior to our entry into the war. They were installed in the larger city theatres but the majority of the theatres over here have low intensity lamps, burning from 15 to 45 amperes; with motor generators, tube and plate rectifiers being in common use.

I have visited a number of towns in New Zealand while in the Air Force, and have been able to get a pretty good idea of what's what in projection circles in this part of the world.

ALLAN B. HARRIS
Napier, New Zealand.

Public Relations in Labor

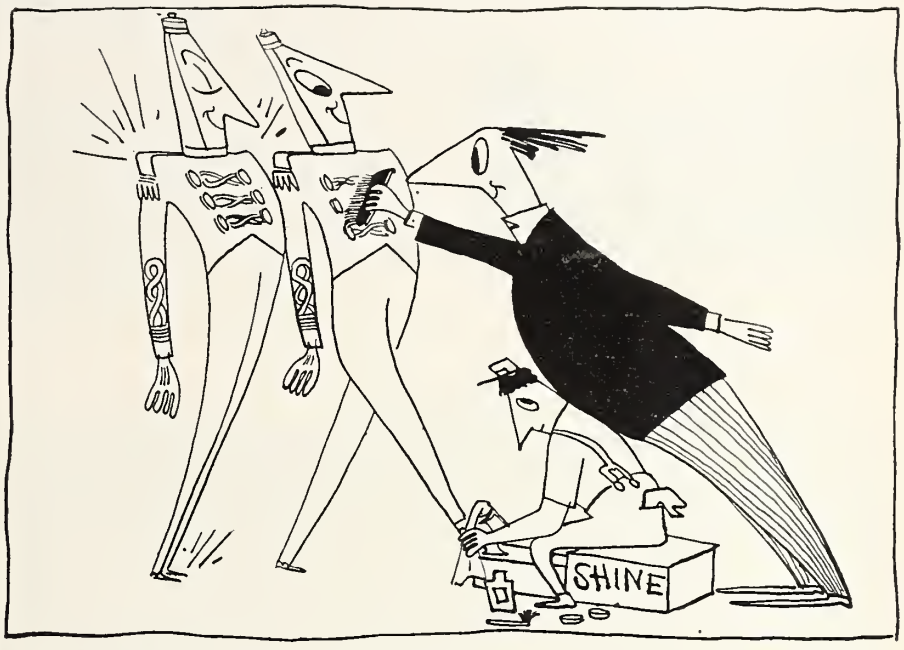
To the Editor of I. P.:

As an avid reader of INTERNATIONAL PROJECTIONIST I have come to the conclusion that this publication is the sole champion of our craft. The informative and educational articles, written by experts, pertaining to high calibre projection, are all absorbing. They have a profound effect upon the individual projectionist, especially in the direction of the "artistry of our profession." These aids to projection are in themselves invaluable and are quite beyond the intrinsic cost of the subscription.

The resultant benefits realized through this medium finds its expression in the personal pride that permeates each member of the craft in knowing that he is part of and associated with a highly technical division of engineering craftsmanship. However, the technological advantages of the present as well as those that will implement the postwar era are, I believe, secondary to other phases of our relationship to that period.

Since the advent of television in postwar entertainment is a certainty, there wisely has been undertaken by the various I. A. locals throughout the country a comprehensive study of this subject in accredited schools. This is sound reasoning in view of the fact that contracts for television projection will be held by I. A. locals in areas where television is shown.

Of great importance, too, is the inestimable value applied to organizational strength that the collective study of this subject signifies. It naturally follows that with a fundamental technical knowledge of television by the general membership, the various I. A. locals are automatically placed in a superior position to bargain



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for better working contracts. It puts into the hands of our leaders a strong offensive potential with which they are enabled to meet and command respect in their conferences for wage scales based upon the technical skill of the craft and current economic conditions. Thus, in the elevation of the general level of our I. A. membership by the voluntary study of this subject, there is introduced a concept that presages an optimistic future of continued progress and advancement.

As previously mentioned, there is a higher relationship in the postwar era than a purely technological one. This relationship, although indexed and categoried in many forms, is fundamentally one of *public relations*. The extent to which labor unions are affected by public relations is indicated by the number of universities of higher learning that have included this subject in their curricula. The subject is approached from the industrial and the civilian reaction, and, as a result, many thousands of our citizenry will view labor with an academic interpretation. This is in itself a wholesome, healthy condition. It compels on the part of all concerned a necessity for continued vigilance and observance of public trends.

Labor unions are strong or weak in accordance with their understanding of two concepts of social practice—*internal solidarity* and *external good will*.

Labor today is no longer an isolated sphere in the orbit of world struggle for recognition and influence. Due to aggressive intelligent leadership and the favorable circumstance of a friendly government, labor today stands upon the treshold of her greatest triumph. Millions of our citizens are now labor-minded and believe in the principles of unionism. Labor today does not shop in a hostile market but a friendly one. That principally is why the emphasis must be placed upon proper public relations, *because public relations are labor relations.*

Ptolemy's excerpts illustrate very forcibly that since the beginning of the world man has found that he can not live apart. So he comes together and in so doing, laws are made, governments arise and thus is created the fundamental pillars of society.

A labor union is solidified internally by the acceptance of a principle by the membership; and honest, capable, efficient leadership of those entrusted to official positions. A labor union obtains good will by encouraging her membership to participate in community activities of a worthwhile nature, remembering that the neighborhood betterment clubs and church outings are composed of people who are identified with labor, for they like ourselves are working people.

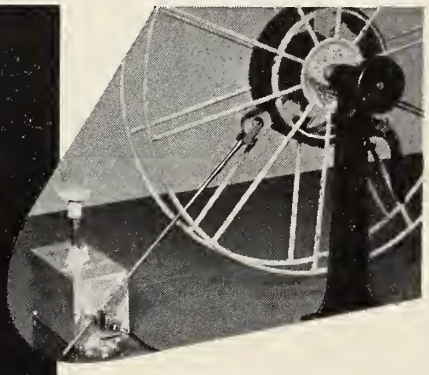
Big business employs public relations counsel, one who by training and experience is expected to bring about good will on the part of the purchaser for the company. Labor need employ no such specialist for happily we all speak the same language. Fair play and equal opportunity and respect for the rights of each other are basic principles that have made the American Federation of Labor the greatest instrument for our collective security.

In the adoption of a strong public relations policy by the various I. A. local unions throughout the country, there is thus created and preserved the permanent medium for reciprocal cordial relationship. The highest court in the land is the court of public opinion. We will always be representative of the spirit of that court for having acquired the common touch in our administration of wholesome public relations—we perpetuate the leadership of our craft and expand the dominion of labor.

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WILSCHKE NAMED ASSISTANT TO BESSEY OF ALTEC

Effective July 16, 1945, E. O. Wilschke became assistant to H. M. Bessey, vice-president of the Altec Service Corp. Wilschke formerly was manager of the Philadelphia district, and more recently production manager of Altec Lansing Corp. in Hollywood.

PROJECTION TELEVISION

(Continued from page 10)

trade names of Lucite and Plexiglas.

A new set of difficult problems came to the foreground. The most formidable of these was that of making molding surfaces of metal in shapes of the negative replicas of aspherical lenses. About as serious was the problem of obtaining optical finishes on metals. Both of these problems have been successfully solved.

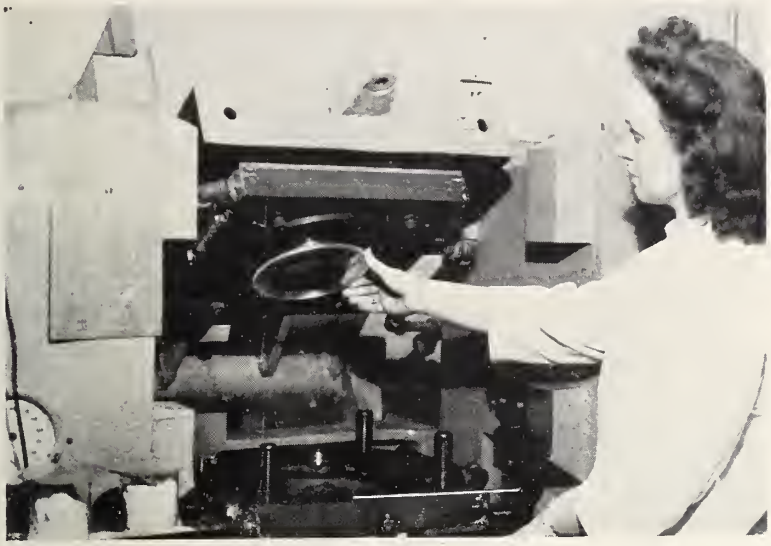


FIGURE 9. ***Open molding press showing the lens attached to the upper molding surface by its flash.***

The molding process is essentially that of applying very high pressure to heated plastic material confined in a heated mold and cooling it under pressure until it reaches room temperature. The mold is then opened and the lens extracted. A view of an open molding press with the lens attached to the upper molding surface by its flash is shown in Figure 9. The only operation which remains is that of boring a hole in the center of the lens for accommodating the protruding neck of the cathode-ray tube. The lens is then ready for use with no polishing or finishing of any sort required.

Molded correcting lenses for reflective optical systems suitable for home projection receivers possess very good optical properties, including slightly better transmission and slightly less scattering of light than glass. They do not possess the surface hardness and scratch resistance of glass, but even without any special care or protection they have stood up under laboratory operation for more than three years. The cold flow under operating conditions of three years was found negligible. The cold flow depends on the operating temperature which for the plastic lens of a television receiver is not far from the room temperature.

So far only the smaller correcting lenses suitable for home projection receivers have been molded. The larger correcting lenses necessary for theatre projection were produced from glass.

The RCA reflective optical systems are designed for projection at a fixed throw and require cathode-ray tubes with face curvatures fixed in relation to the curvature of the spherical mirror. A number of these systems have been developed for both home and theatre television suitable for projecting television images with diagonals ranging from 25 in. to 25 ft.

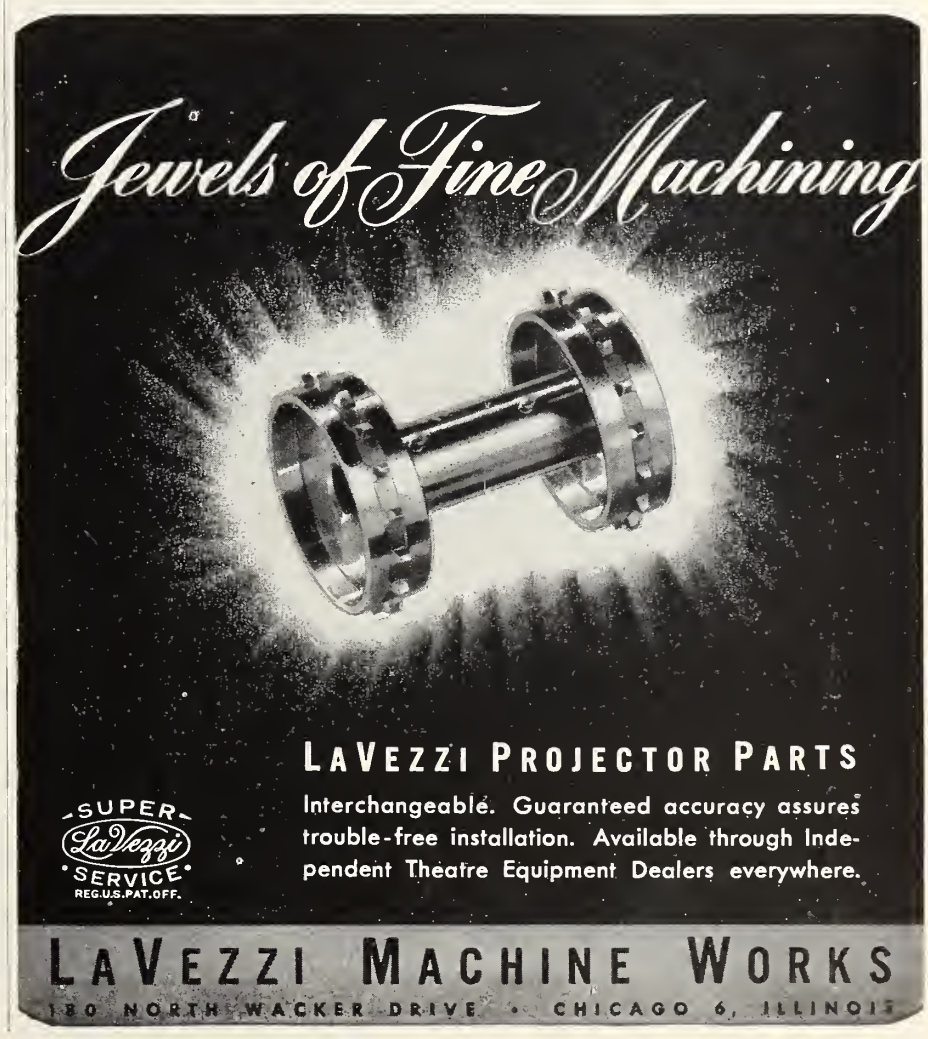


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AT YOUR SERVICE

(*Continued from page* 21)

moving the resistor entirely, it also may be replaced by one of higher resistance.

3. As an emergency repair, when a Bell and Howell clutch slips because any of the four fingers in the clutch assembly have broken, they can all be removed and the bushing screwed up tight.

4. When necessary, a Bell and Howell governor can be used on an Ampro or Victor projector by drilling out the governor to fit the shaft of the Ampro or Victor motor.

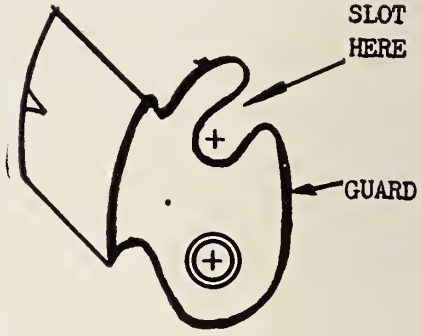
5. If a Bell and Howell oscillator delivers excessive voltage to the exciter lamp, the condition can be corrected by removing the screen resistor and substituting one of higher rating. For example, substitute a 50,000 ohm resistor for the existing 30 or 39 thousand ohm resistor.

6. A fine oil stone can be successfully used to take out minor hooks in the shuttle teeth of Victor and Ampro projectors.

7. Wows occasionally develop in Victor projectors because of wear in the brass bushing of the sound sprocket shaft. A new bushing can be made in any machine shop. — Cpl. J. Thorman, *APO* 528, *N. Y. C.*

Removing Film Guard on MI-9030 and 9050 Soundheads

On several installations I have slotted the lens guard on MI-9030 and 9050 soundheads so that the guard can be rotated about the lower mounting screw,



thus allowing the projectionist to clean the front face of the lens when necessary without removing the entire guard. See illustration above.—Dave Waddell, *RCA.*

Bristo Screw for Aperture Stripper

The headless cup point set screws used to hold shaft of aperture strippers frequently become loose. It is practically impossible to tighten them without removing the aperture, and if too much force is used the set screws will break. I find that the No. 6 Bristo screw makes a good replacement, and can easily be tightened with a Bristo wrench.—H. J. Brown, *ALTEC.*

Overcoming WE Kinetic Scanner Flutter and Wows in 209 and 211 Reproducers

Instances of flutters and wows have been overcome by applying the following mixture to drive belts. Mix pure grain alcohol with powdered rosin until you obtain a paste-like mixture. In time this paste will harden but it can be restored to a softer consistency by merely adding a little more pure grain alcohol. This has worked well in overcoming the stubborn evils in this type of reproducer—that is, poor pickup and running speed, as well as flutters and wows.

An application of this mixture on leather belt takeups will be found to be very effective. The takeup belt with this treatment may possess much more slack and will also insure a firmer and more even takeup.—Leo Cimikowski, *RCA.*

RCA PROMOTES E. T. BROWN

E. T. Brown has been named theatre service field supervisor by the RCA Service Company for the Chicago district. Mr. Brown for many years was a theatre service engineer in the New Orleans area, and for two years prior to his present appointment carried out military assignments both here and abroad as a member of the Service Company's Government Department.

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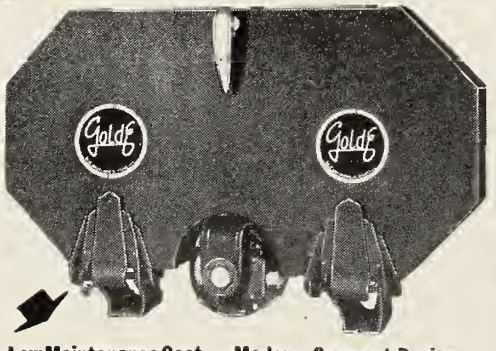
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Presenting: John A. Shuff



JOHN A. SHUFF, business representative of IATSE Local No. 364, Akron, Ohio, was born in Seneca County, Ohio, and, like the late President Wilson, found that 13 is his lucky number. However, he was born somewhat later than Mr. Wilson, the date having been September 13, 1900. Just 13 years ago he retired as secretary of Local 364 to become its business representative. At that time only 13 of the 45 theatres in the Akron district were organized, but within 18 months after assuming his new duties the entire Akron jurisdiction was 100 per cent unionized—and still is.

Shortly after he left business college in Toledo, Ohio, Shuff was attracted to the theatre, serving first as a doorman and then as an usher in Toledo theatres. He arrived in Akron in 1917, and has been active in union and civic affairs in that city ever since. In 1925 he became secretary of 364, and has served continuously since that year in an official capacity.

When he became business representative of the Akron local, it was disorganized, with there being much dissension between the members and theatre owners. Working on the theory that "no union can be half slave and half free," Shuff decided it was time to do something about the matter—and he did. He first organized an educational campaign to prove to the exhibitors and projectionists alike that everyone would benefit if the theatres in the area were unionized.

During the first few months, of course, it was an uphill fight. Theatres were picketed, but eventually union agreements were signed—one by one, and eighteen months after Shuff launched his campaign, every theatre within a radius of 25 miles of Akron employed union projectionists. The result was that harmony replaced discord, wages rose and working conditions improved.

Since he has been business manager of the local Shuff has seen the wages of projectionists increased by 40 per cent, with every contract carrying clauses covering overtime pay and vacations with pay.

Under his leadership Local 364 has taken an ever-increasing part in civic affairs, contributing generously to the Red Cross, United War Chest and other activities. A majority of the members have enrolled as blood donors and 25 per cent are serving with the Armed Forces.

Shuff is a member of the executive board of the I. A. Ohio State Association. He is active in Masonic affairs, being a 32nd Degree Mason. He is a member of the Valley of Canton Consistory and of the Usef Khan Grotto and Tadmor Shrine. Mrs. Shuff is also active in auxiliary Masonic bodies.

Their one son, Robert, who is a member of the projectionists' local in Tiffin, Ohio, attended Heidelberg University and obtained his law degree at Western Reserve University, Cleveland. In 1943 he was made assistant general counsel for the United Rubber Workers of America International Union, with offices in Akron. Like his father, young Shuff is an ardent unionist.

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N.T.S. MANAGERS DISCUSS NEW POST-WAR PRODUCTS

Executives and managers of 13 of National Theatre Supply's branches in the mid-west and southern territories gathered in St. Louis on June 2 and 3 to discuss new post-war products, and ways and means of speeding vitally needed equipment and supplies to exhibitors just as soon as restrictions are lifted. G. C. Atkins, of the Atkins Popcorn Co., Dallas, opened the meeting on June 2.

W. H. Rademacher, manager of the Mississippi Valley Sales District Lamp Department, demonstrated the new G. E. "Slim-Line" lamps, which are distributed by National, at a luncheon tendered by the General Electric Co. He explained that the revoking of the WPB limitation order will soon make it possible for exhibitors to get all types of lamps.

In addition to new products conferences, meetings were held to discuss company problems, and the sessions were topped off by entertainment and a dinner given by W. E. Green, National president.

National executives and branch managers attending the meetings included Mr. Green; O. S. Oldknow, vice-president; W. G. Boling, Charlotte; J. F. Bommerschein, Indianapolis; R. L. Bostick, Dallas and Memphis; J. C. Brown, Atlanta; R. W. Dassow, Chicago; Arthur "Count" de Stefano, Kansas City; W. C. Earle, St. Louis; J. H. Kelley, Cincinnati; F. W. Keilhack, Kansas City; T. W. Neely, New Orleans; R. W. Pries, Des Moines; J. I. Watkins, Oklahoma City, and J. W. Servies and C. Williamson of Detroit.

W. E. COMPANY OF MEXICO NAMES ZINT VICE PRESIDENT

E. S. Gregg, vice-president and general manager of the Western Electric Export Corp., announces that Karl E. Zint, until recently engineering advisor to the 21st Bomber Command in the Pacific, has been appointed vice-president of the Western Electric Company of Mexico. He stated that Zint's appointment is made in anticipation of an expected increase in the company's Mexican business, particularly in the field of sound recording.

Mr. Zint has left for Hollywood for an inspection of new equipment scheduled for production as soon as war conditions permit. He will arrive in Mexico City about July 20, by which time it is expected that the installation of the seventh Western Electric recording channel to the Azteca Studios will be under way. The first six channels were installed during recent months, and still the demands of Mexican producers for recording facilities are outstripping available equipment. Orders now are on hand for a number of additional units, and it is expected equipment will be available within a few months.

RCA SERVICE TO FOX THEATRES STARTS TENTH YEAR

RCA sound service has been contracted for by the National Theatres Amusement Company, Inc., for the tenth year, according to an announcement by W. L. Jones, vice-president of RCA Service Company, Inc. More than 300 theatres are involved, located in the Far West, Northwest, Rocky Mountain area and Wisconsin. These theatres comprise the Fox West Coast Theatres, Fox Inter-Mountain Theatres, Fox Wisconsin Theatres, and Evergreen State Amusement Divisions of National Theatres Amusement Company.

ALTEC EXPECTS TO SHIP NEW LINE IN OCTOBER

Altec Lansing Corporation expects to ship its new line of theatre loudspeaker equipment about Oct. 1, 1945, according to an announcement by A. A. Ward, vice-president. The line is described as surpassing, in presence and realistic reproduction, anything heretofore available. This equipment will be available to manufacturers for incorporating in their complete theatre sound systems, and also for step-by-step modernization through appointed dealers. Changeover to the new loudspeaker line is made possible by advanced engineering and improved production technique.

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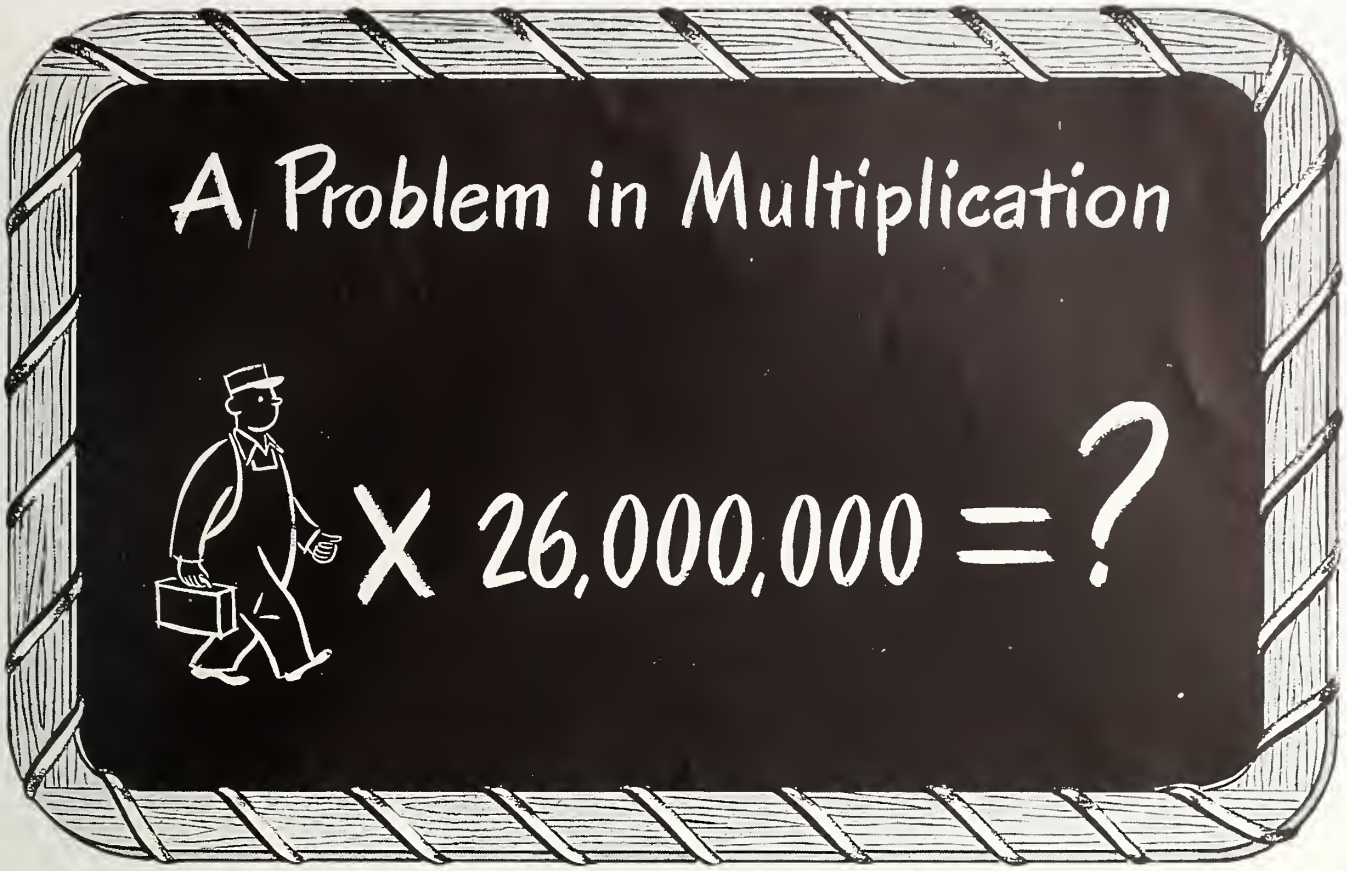
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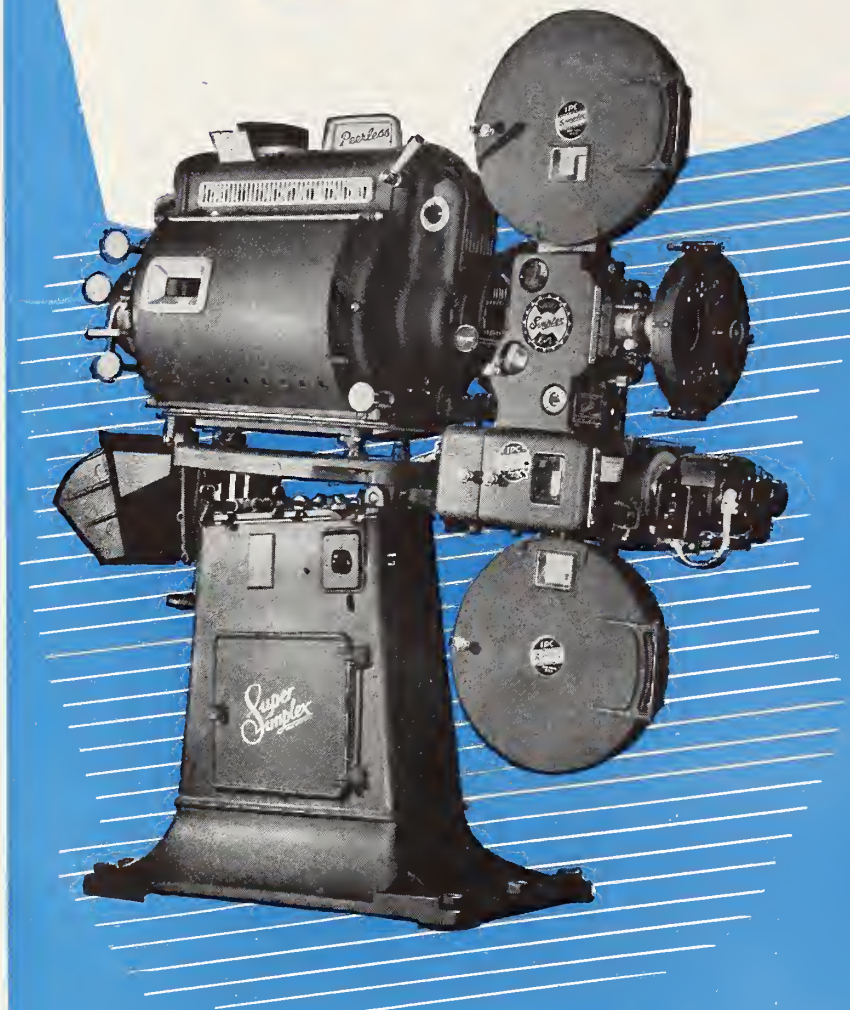
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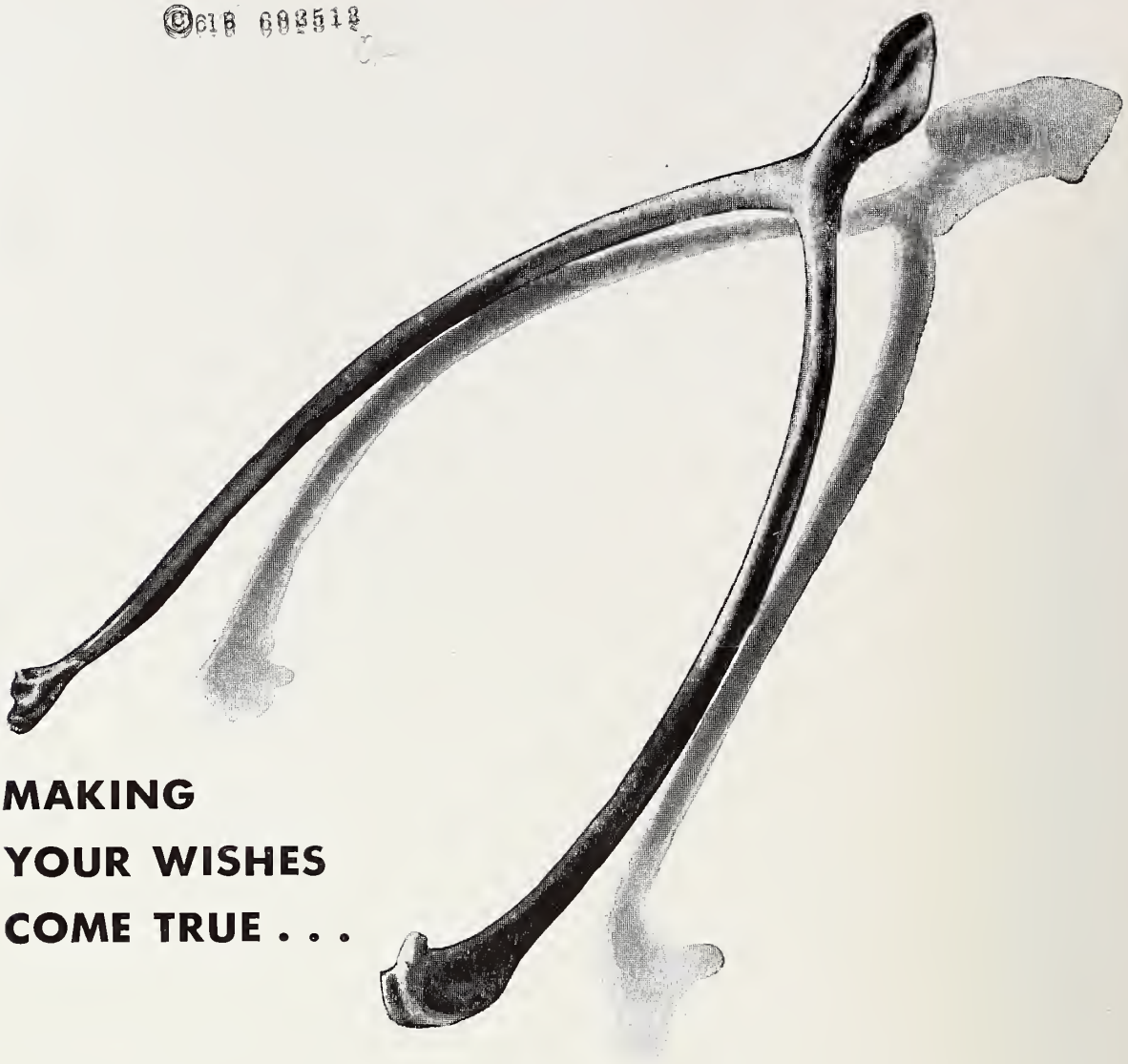
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VOLUME 20 • NUMBER 9

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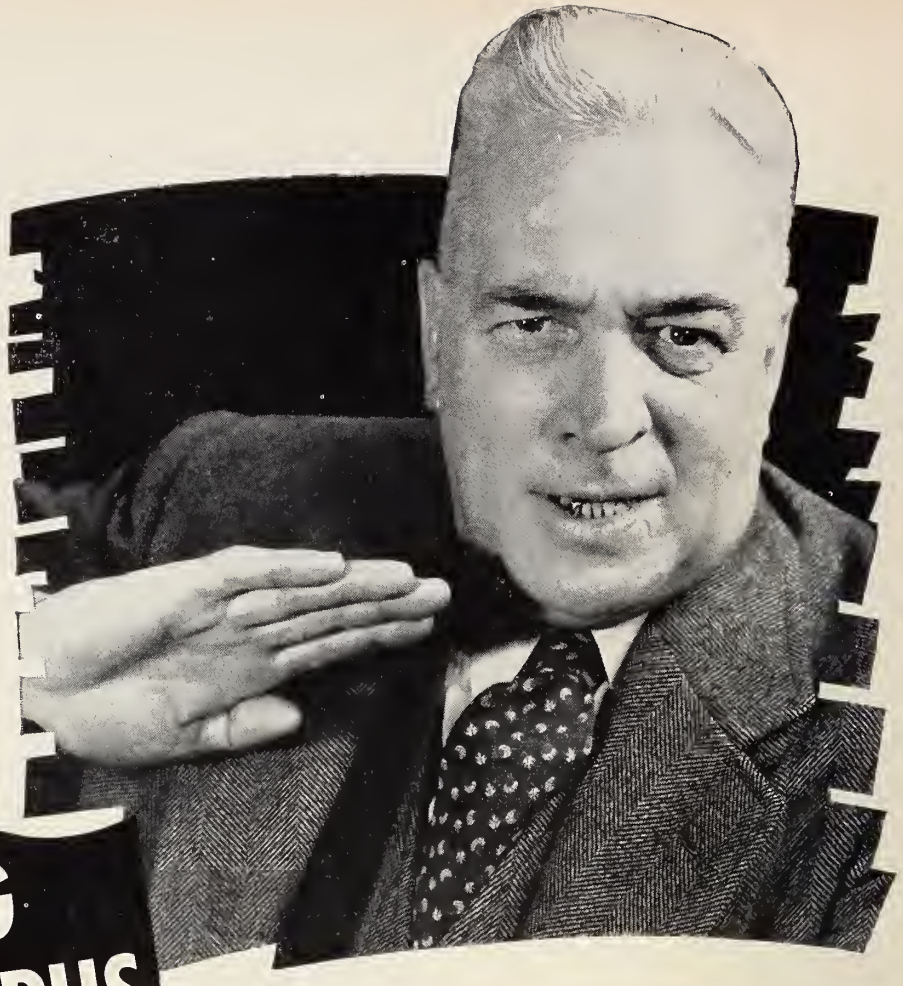
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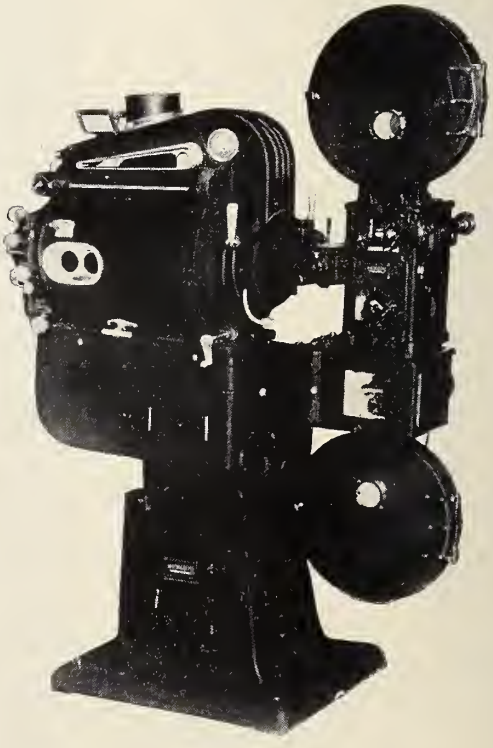
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INTERNATIONAL PROJECTIONIST

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W. L. Lightfoot, *Associate Editor*

Volume 20 SEPTEMBER 1945 *Number* 9

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MONTHLY CHAT

THIS YEAR the annual drive for the National War Fund starts on Oct. 9 and will continue through Nov. 15. It seems hardly necessary to emphasize the need of 100 per cent cooperation of the film industry in the individual drives throughout the country. In the past the industry has made an enviable showing in these campaigns, and it is to be hoped, even though the wars are over, that not a bit of zeal will be lost in the forthcoming program, regarded as being even more important than previous ones, due to the large number of returning veterans, both unscathed and wounded. Funds collected are used by relief agencies abroad and by a number of domestic groups. Both the armed services and disrupted civilian populations benefit. The time is near, and no one must be able to say that the film industry did not do better than 100 per cent in this important drive. The industry cannot rest on past performances. It must make a new record.

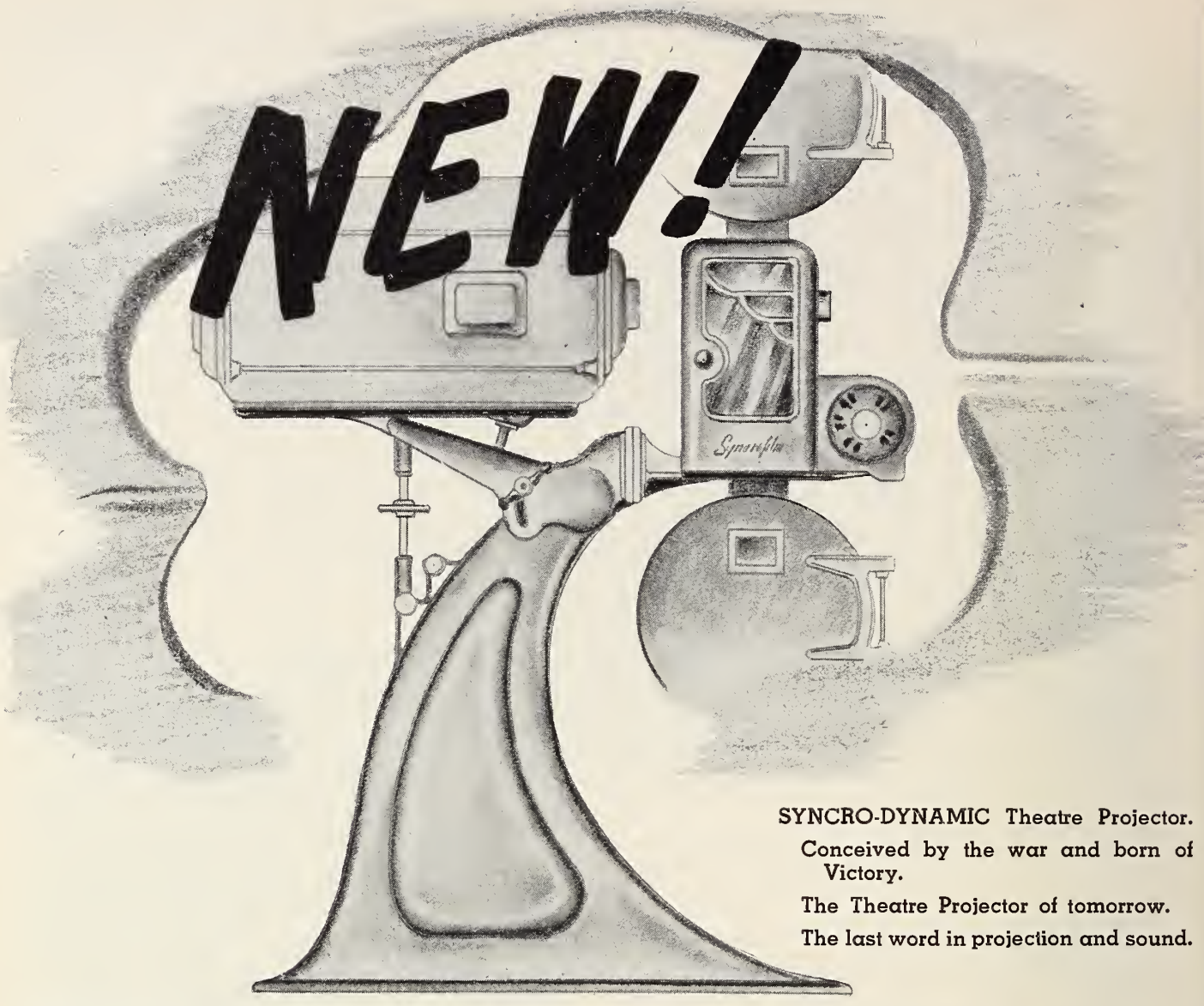
• • •

Projectionists who have been getting along with equipment available will find excellent opportunities at three forthcoming conventions to get an idea of what is going to be offered in the way of new models. In Chicago on Oct. 5 to 7, much equipment will be on display in the Edgewater Beach Hotel, where meetings of the Theatre Equipment and Supply Manufacturers Association, and the Theatre Equipment Dealers Protective Association will be held. About a week later similar opportunities will be available in New York, when the SMPE will hold its semi-annual gathering at the Pennsylvania Hotel on Oct. 15 to 17. With the industry practically "starved" for new and improved equipment, it will be well worth while for individual theatres to arrange for attendance of their projectionists at the displays. The opportunities to view many lines under one roof will not be available again for some time, and it would seem that for those projectionists in the areas noted a visit should be essential. Many changes are here and on the way. Alert projectionists will be sure that they are versed in the new equipment picture.

• • •

I.P. always is interested in receiving from subscribers news items of any sort, and particularly of the activities of the various local unions. Some believe that it is necessary that they be an officer of a local in order to send along bits of information that would be of interest to the craft-at-large. Such is not the case. If you have something worthwhile in the way of news or developments, jot it down and send it in. This goes, too, for all those projectionists who are in the armed services. Many of them already have written in newsy letters that have appeared in these columns, and which in several instances have elicited very favorable comment from the boys at home.

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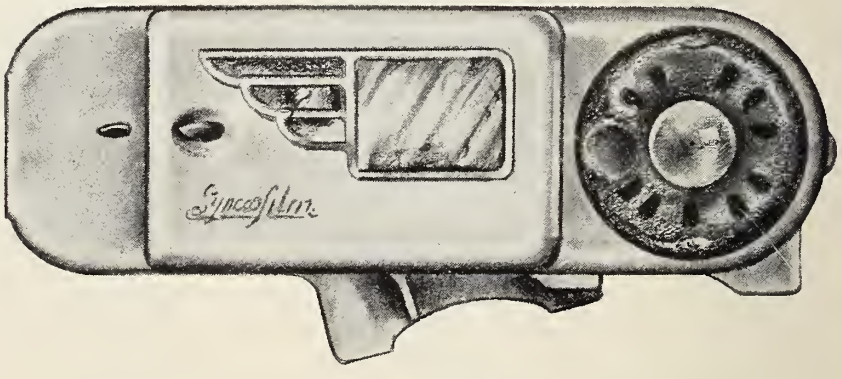
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INTERNATIONAL PROJECTIONIST

VOLUME XX SEPTEMBER 1945 NUMBER 9

A Wartime 16-mm Projector: Its Operation and Maintenance

By *AARON NADELL*

I. P.'s presentation of 16-mm projector details is here continued with an account of the construction, operation and maintenance of another model of such equipment. The schematic of the amplifier used with this apparatus will be traced in detail in a subsequent issue. Similar descriptions, covering other makes and models, will appear from time to time in the future.

BORN OUT of military needs in the war emergency and including many battle-tested features which undoubtedly will be incorporated in peacetime commercial equipment, the RCA PG-200-A is a 16-mm sound film projector designed to U. S. Army Signal Corps specifications. This projector was extensively used on fighting fronts all over the world.

Figure 1 illustrates the entire equipment (less the screen) as partly set up for operation. The reels, which are carried in the speaker case, have not yet been placed on the reel arms. The speaker cable is plugged into the amplifier; the power cable is still coiled and has not yet been plugged into a source of a.c., although one end of that cable is plugged into the projector.

In Figure 2 the projector is shown set up and threaded, ready for operation. The perforated area at extreme left is the casing of the amplifier. The vertical panel just right of it contains (from top to bottom) volume control, tone control, amplifier pilot lamp, amplifier switch and fuse side by side, receptacle for a.c. power cable, and receptacle for speaker cable.

Next right of this amplifier panel, in Figure 2, is the panel that holds the projector lamp. By loosening the screw at the top this panel, which hinges outward at the bottom, can be tilted toward the reader, as will be seen in greater detail by referring to Figure 4. The projection lamp, mirror and condenser lenses are thus made accessible. Below the screw just referred to is a medallion bearing the RCA trade-mark; beneath that is a knob which controls the lateral positioning of the projection lamp. Underneath this, and also side by side, are the projector lamp and motor switches.

The face of the thin panel next to the right shows only a single control—the framing knob—directly in line with the

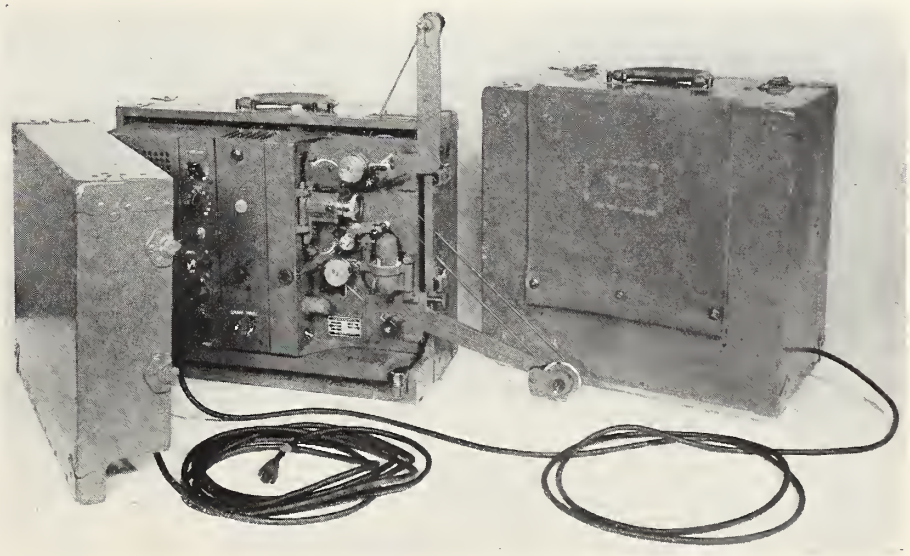


FIGURE 1. ***The complete 16-mm system, partially set up for operation, with reel arms in operating position and loudspeaker cable plugged into amplifier. Note that the loudspeaker cable is connected before the cables, just to avoid any chance that the amplifier might accidentally operate without a load.***

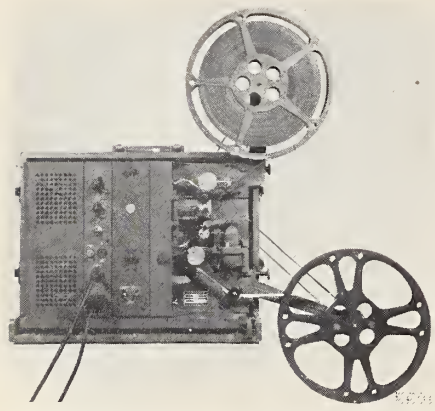


FIGURE 2. *The projector completely set up for operation, reels in place, and film threaded.*

knob or thumb-screw for lateral adjustment of the projection lamp. The two-tooth claw which imparts intermittent motion to the film (replacing the intermittent sprocket of 35-mm practice) engages the film at a point between this framing knob and the projection lens assembly.

Operating Side Details

The operating side of the projector proper (Figure 3) shows—toward the top—the upper sprocket, and just to right of it may be seen the rewind lever. The projection lens is focused by revolving its knurled barrel; the focusing locknut, a thumb-screw, is at the top of the lens holder. To the left of this is a knurled pin which, when lifted, permits removal of lens holder and gate. Almost directly below the knurled portion of the lens barrel, the film passes between the rotary stabilizer sound drum and the felt-faced sound drum pressure roller.

The rotary stabilizer of this mechanism is a counterpart of the one used in RCA 35-mm soundheads. It is oil-damped, mounted on its own ball bearings inside the stabilizer case. Its shaft assembly is ball-bearing mounted at two points outside the case. Each ball bearing assembly is in itself a complete unit, shielded against dirt and removable as a unit.

Directly right of the rotary stabilizer sound drum shown in Figure 3 is the sound optical assembly consisting of shielded exciter lamp and the lens tube. The photocell is invisible behind the exciter lamp. Invisible behind the stabilizer drum is a small mirror by means of which the light beam is reflected into the photocell.

The lower sprocket is left of the exciter lamp-lens tube assembly—just a bit lower down. Left of and below the lower sprocket is a hooded threading lamp and directly beneath this is the threading lamp switch. A white guide line permanently embossed on the frame serves as an indication to correct threading.

To the right of the lower sprocket is a thumb screw which, when loosened, permits the exciter lamp and lens assembly bracket to hinge outward, toward the reader, as can be understood more clearly by referring to Figures 4 and 5. The take-up rewind lever, just right of the upper sprocket, is illustrated in take-up or operating position; when it is thrown upward and to the left the projector serves as a rewinder.

Sprockets, Springs, Etc.

The sprockets, as Figure 3 reveals, are oversize. They have 16 teeth each and can be disassembled and the teeth reversed, thus doubling their useful life. The belts in Figure 3 are metal spring type of the hookless variety. That is, the ends are oppositely tapered, and are fastened together by threading the tapered male end into the spiral of the female end very much as threaded conduit is joined to a threaded fitting.

The knurled knobs at the right of Figure 3, just under the upper reel and left of the lower one, serve to fasten the reel arms to the projector. When the apparatus is taken down for transportation, reel arms and reels are mounted inside the loudspeaker case. The control for the projector tilting device is seen at the bottom of the illustration, just left of the lower reel; it can perhaps be seen more clearly in Figures 1 and 2. It is operated by thumb and forefinger to lift or lower the front end of the projector.

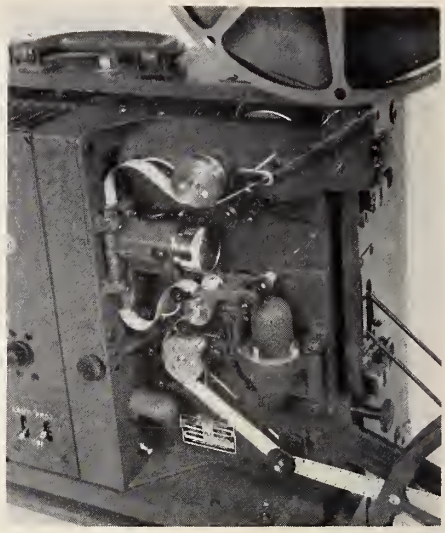


FIGURE 3. *Film correctly threaded, following white threading guide embossed on the projector main frame.*

The film threaded in Figure 3 is silent 16-mm stock, perforated along both edges; 16-mm sound film is perforated only at the edge opposite the sound track. It will be observed that there are sprocket teeth only at the outer perimeter of each sprocket. The position occupied in the illustration by the line of sprocket holes farthest from the reader is that normally occupied by the sound track.

Components Readily Dismounted

In Figure 4 the equipment has been partly taken down for servicing. The projector lamp, condenser assembly and projection-lens-and-gate assembly are seen

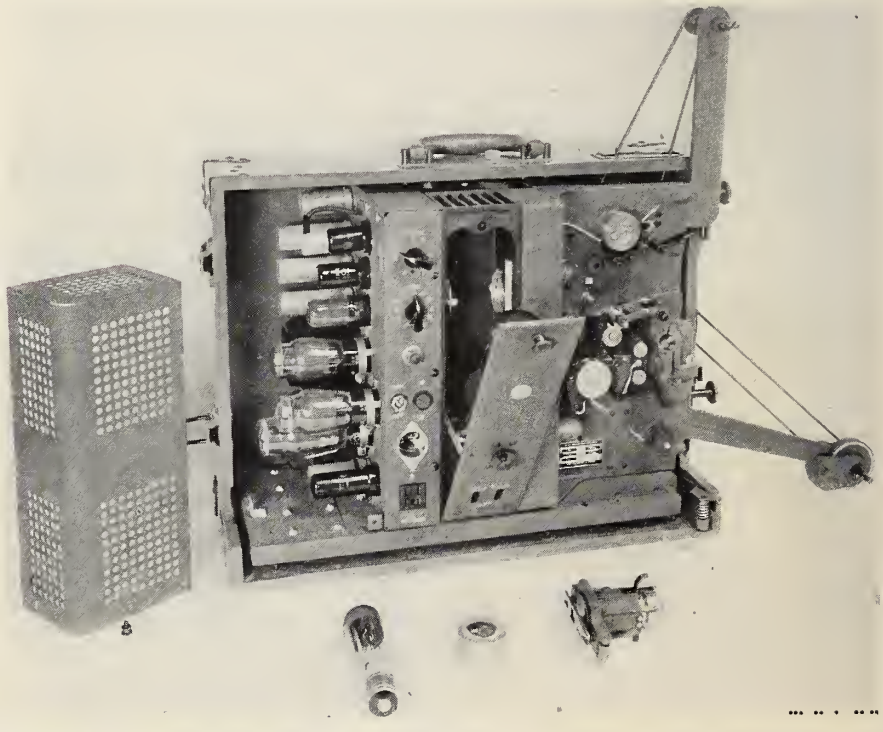
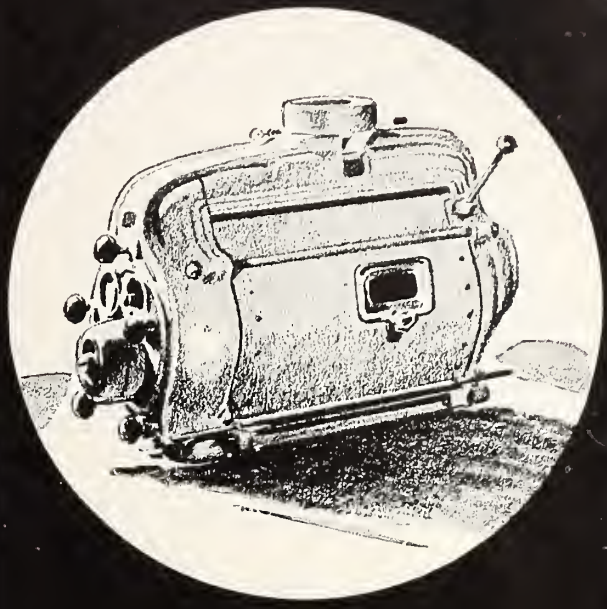


FIGURE 4. *Partial disassembly for maintenance or repair, showing amplifier cover removed, and projector lamp, condenser and lens removed. No tools are needed to disassemble the equipment as far as shown in this picture.*



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"The World's Largest Manufacturers of Projection Arc Lamps"

removed from the projector. All can be removed without the aid of tools. The lamp rating is 750 watts; lamps up to 1.000 watts may be used. The condenser assembly consists of two optical elements, one aspheric. An fl. 65 two-inch lens is standard equipment.

The projection lamp panel is seen hinged toward the reader and downward —it should never be thus opened without first switching off the lamp. A cooling blower (not visible in this illustration) is attached to the projector motor shaft.

The exciter-lamp-and-lens-tube assembly is seen hinged outward toward the reader in such a position that if the lamp were lighted the light beam would be directed toward the reader's left hand. Power and speaker cables have been disconnected and the cover removed from the amplifier.

The take-up is shown at the outer end of the lower reel arm. It consists of one rotating element inside another, friction-connected through a layer of felt, the outer element driving the inner one. The increasing weight of the lower reel as film is taken up proportionately increases the pressure on the felt.

Sound Optical System

In Figure 5 the exciter lamp cover has been removed, and the lamp and lens tubes have been hinged outward towards the reader. The black photocell shield is visible to the right of the exciter lamp. To the right of the rotary stabilizer drum there is a glimpse of the mirror by which the exciting light, after it has passed through the sound track, is reflected back to the photocell. This exciter lamp is of the 4-volt, ¾ amp., prefocused type.

Toward the lower surface of the lens tube, at the end nearest the exciter lamp, there is a small hole by means of which azimuth is adjusted. Any convenient pin or nail, or blunted ice pick, can effect this adjustment. Just left, in the casting that holds the lens tube, is a larger hole through which the exciting light focus is adjusted. For this a special tool is needed. A trifle higher up on the casting is the screw that locks azimuth and focus adjustments once they have been made.

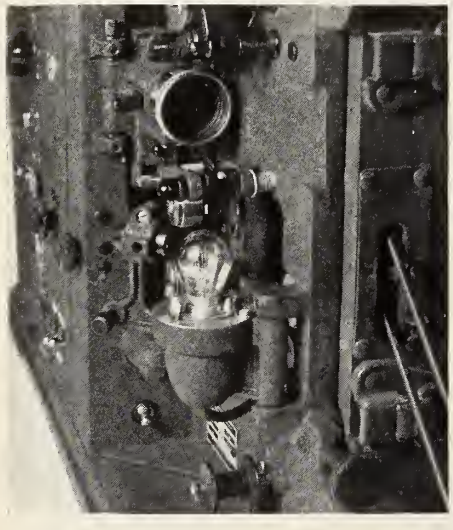


FIGURE 5. ***Sound optical system partly disassembled and rotated out of normal operating position to show the construction more clearly. The photocell is under the black hood to the right of the exciting lamp.***

Projector Mechanism

Mechanical details of the projector are shown in Figure 6. The motor can be seen at the lower left. This is a 1/20th h.p. heavy duty, constant speed induction motor with capacitor starting. Directly above the motor is the circular black casing of the rotary stabilizer. To the right of the motor is a three-point terminal strip, and above and right of this strip, mounted edgewise toward the reader, is the flywheel (light-colored in the photograph). Just left of the flywheel is a glimpse of the V-belt that drives it, and left of that may be seen the lowest gear in a three-gear train. The middle gear is part of the cam-and-gear assembly actuating the intermittent claw. A two-bladed, balanced shutter is bolted at three points to the uppermost gear. These bolts are loosened for trimming the shutter.

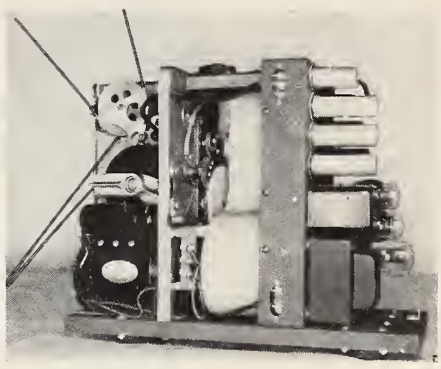


FIGURE 6. ***The projector largely disassembled, revealing many mechanical details of its construction.***

Between the rotary stabilizer and the flywheel, mounted under two screws, there can be seen a piece of metal having very roughly the shape of an inverted *L*. This is part of the framing linkage. A shaft, barely visible in Figure 6, joins it to the framing knob seen in Figure 2 .This linkage provides framing control on the same principle used in 35-mm projection—that is to say, not by shifting the aperture but by altering the average position of the film, so that the center of the picture always remains in the optical axis of the projection light beam.

The black photocell cable can be seen in Figure 6, top center, connecting to the three-point PEC terminal strip at the upper end of the amplifier chassis. At the bottom of the amplifier chassis there is a two-point terminal strip which supplies a.c. at approximately 28.000 cycles for the exciter lamp.



FIGURE 7. ***The amplifier, removed for servicing.***

The power transformer may be seen to the right of the exciter lamp terminal strip. Above the power transformer is the output transformer, which is directly below four tubular condensers. To the right of the power transformer can be seen the 5U4G rectifier tube, and above it are the two 6L6G tubes. Other tubes of the amplifier are not visible in this photograph.

Figure 7 shows the amplifier removed from the projector for servicing.

The loudspeaker, concealed within its case in Figure 1, is a 10-inch, 20-watt dynamic with an Alnico permanent magnet. It operates normally with the rear of the speaker case closed.

Operating Details

In setting up the projector, reel arms, reels and cables are removed from the speaker carrying case (which also has compartments for spare tubes, fuses and so on) and the projector is then assembled with reel arms, reels and belts in place as illustrated. Belts are carried inside the projector, not in the speaker case.

It is important to plug in the loudspeaker cable first of all, so as to make sure that the amplifier is not accidentally switched on when there is no load attached to it.

When the screen (which is an entirely separate unit) has been set up, projector and speaker are located in suitable relation to it. The speaker is commonly placed on the floor under the center of the screen. The projector is placed on a table located where the heads of the audience will not intercept the light beam —usually in a central aisle, or on a rear platform. The screen must face the light beam at right angles.

When the projector, speaker and screen have been properly located, and *after* the speaker cable has been connected, the power cable may be plugged in. Projector and projection lamp switches are

(*Continued on page* 28)

Just What will I gain with HIGH INTENSITY PROJECTION?





LOW INTENSITY PROJECTION

HIGH INTENSITY PROJECTION

The gains you make by switching to "National" High Intensity Projector Carbons show up not only on the screen but at the box office.

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Auditorium and stage of Radio City Music Hall. The width of the stage opening measures 100 feet.

Projection at Radio City Music Hall

THIRTEEN men, all members of Local No. 306, New York, operate projection equipment in the gigantic Music Hall at Radio City, working in two shifts. They run the same films that are shown everywhere and use pretty much the same equipment, but their job is exacting beyond the requirements that face most projectionists.

Suppose, for example, the show broke down. That has never happened yet, and probably never will. Handing out six thousand refunds would be pretty expensive business, not to mention the effect upon the reputation of the Music Hall. There must not be any breakdown.

Ample facilities are provided as insurance against all possible trouble. For example, there are four projectors. But even four projectors would be no insurance if they were not properly maintained.

Projectionists at Radio City never neglect their equipment. In the middle of the day, in the middle of a show, the interior of the lamphouse that was used just five minutes ago looks as if it had newly come from the factory. Not a trace of dust can be seen at the back of the amplifiers. The projector mechanisms might be show pieces instead of working projectors.

Charles Muller, chief projectionist, whose own experience goes back to nickelodeon days, believes that extreme cleanliness is the supreme precaution against all forms of trouble. Endless inspection of every detail of the apparatus goes hand in hand with endless cleaning of every detail.

Two Shifts a Day

The extreme care and cleanliness that are routine with the Radio City staff does not require any unusually large number of projectionists. There are two shifts for each working day; three men to a shift.

Men report in the morning one-half hour before show time. Each man proceeds at once to the portion of the equipment which it is his job to maintain, including his own projector. It may seem that a man can't get very much done in only half an hour, but he doesn't have too much to do. He finds his equipment clean and in perfect order. He has time enough to spare in that half hour to inspect the first reel he will run in the day's show.

Two men of each shift run the show. The third, or key man, supervises, double-checks every detail of the work of the other two, stands ready at all times to step in if the least thing should go wrong. Consequently, so far as the audience is concerned, nothing ever goes wrong.

Each man operates his own projector throughout the course of the day. Each man runs the same reels that he ran in the preceding show, and each one cleans his lamphouse and projector, inspects and rewinds his film, while the other man's reel is running. If an occasion is ever encountered when one man can't get through everything he has to finish before it is his turn to run his next reel, the key man steps in and helps him. No detail of cleaning, adjustment or repair is put off until "later," except only in the case of some major difficulties, which are extremely rare. In such cases there are spare projectors, and a dual sound channel for the protection of the audience.

Telling what it feels like to work in the world's Number One projection room, and the duties and obligations that go with the job.

The day's second shift follows a similar routine of inspecting and cleaning the apparatus, when it takes over early in the evening.

Projection, of course, is not continuous. It is interrupted periodically by the stage show. During the stage show, two projectionists operate the spots or spot and effect machine while the key man stands by as when film is run.

There are two Hall & Connolly spots and one Brenkert effects projector. These must, of course, be operated in the smoothest kind of cooperation with the business of the stage. To miss a cue is substantially as great a sin as a poor changeover in running film. Rehearsals, carried out after the show, are necessary for the projectionists as well as for the stage personnel.

Spot and effects machines are kept in immaculate condition in the same way as projection apparatus. Caring for them is as much part of the daily routine as caring for any other piece of equipment.

The lengthy period during which the stage show is running affords an oppor-

tunity for shutting down the projection and sound equipment to make any reasonable repairs or adjustments that cannot be completed during the showing of film, and the key man concerns himself with such repairs if necessary. Similarly, any adjustments that the spot or effects projectors require can be made, in practically every case, while film is being projected.

Muller is available for advice and guidance and help if necessary, and he is familiar with almost every kind of equipment ever used in projection for the past thirty-seven years. Service inspectors also can be called in, and usually arrive within a few minutes' time.

The Music Hall doesn't try to make old or obsolete apparatus "do a little longer." Whenever anything new in the way of projection equipment is put on the market Muller makes it his business to find out all about it. If he thinks it is better than what he has he wants it, no matter how new his existing equipment may be. And when the chief projectionist wants something, the management tells him: "Go get it."

The projectors are arranged in an impressive-looking battery along the front wall, the sound equipment is built into the rear wall, and that is about the only equipment visible in the projection room proper. Two smaller rooms, to right and left of the main projection room, house the spot and effects projectors.

A door in the rear wall of the projection room opens into an office. The sound equipment itself constitutes a large part of the wall between this office and the projection room. Thus there is a whole office-full of space behind the sound amplifiers and they can be cleaned, and worked on when necessary, with utmost ease. From this office, another door opens into the rheostat room. The rewind room is reached through one of the spot rooms. The lavatory, complete with showers, is alongside the rewind room.

The immaculate, Dutch-kitchen cleanliness of this suite of rooms and of all their equipment and fittings, is the work of the projection staff only. The theatre cleaning staff has only one duty in connection with the suite—mopping up the linoleum floors.

Constituting a miniature theatre of 100 seats the pre-view room, also under the care of Charles Muller, serves the dual purpose of providing entertainment for Radio City's 500 employes, and of assisting the management in its booking of pictures. These two purposes interlock. Films under consideration for possible future showing are run in the pre-view room and employes not on duty at the moment are welcome to attend. The management bases its decision on booking the picture in considerable part on the reaction of this employe audience.

An additional and highly important function of the pre-view room is that of checking all prints. Every foot of every print is not only inspected, but actually projected through the E-7's of the pre-view theatre, before the print ever reaches the Music Hall projection room.

Two additional projectionists, apart from the 13 employed in the Music Hall, are on regular duty in the pre-view room, and one of the Music Hall's 13 divides his time between the pre-view room and the large theatre.

Projection Details

The projection distance, in the Music Hall, is 198 feet. Projector arcs burn 180 amperes each. Screen width is 44 feet, 7 inches for newsreels, masked down to 31 feet, 3 inches for features. Approximately 24 million feet of film are projected in an average year.

The resources of the theatre include a library of sound effects, recorded on film. These are sometimes used in connection with the stage show and include such sounds as thunder, cannon, gun shots, and train, airplane and automobile noises. The regular sound system must, of course, be kept in operation, and cannot be shut down for any repair work, whenever such an effect is to be used.

Other sound associated with the stage show, however, is taken care of by an entirely separate P. A. system, the equipment for which is not located in the projection room, and is not any part of Muller's responsibility.

The screen is of the differentially perforated type; perforations at the center being larger in diameter than those toward either side, thus providing substantially even light intensity over the entire screen area.

Each shift works approximately six hours a day, either four or three days per week. The shift that works three days one week reports on four days the week following, and they continue to alternate. There may be a little overtime beyond the daily six hours, for the show sometimes, although not always, runs 13 hours.

Music Hall's policy of unhesitatingly replacing perfectly good equipment with anything newer and better the moment such appears is responsible for some overtime work in connection with these replacements.

There is also some overtime in connection with each new stage show; for the projectionists must learn the spot cues, and practice them in association with stage rehearsals. These occasions are not too frequent, however, since Radio City does not change its show every week, nor, sometimes, every month.

The twelve projectionists who constitute the staff of the main theatre are Irving Bloom, August Brower, Isadore R. Cohn, Robert Hart, Roy Hill, William Jackson, Joseph Kleinman, Benjamin Olevsky, George Rebentisch, Victor Savage, Philip Seligman and John Tillman. Rebentisch divides his time between the theatre and the pre-view room, and David Narcey and Walter Smith make up the pre-view room projection staff.

Their chief, Muller, first became a "projectionist" in 1908, when he and other neighborhood kids in Ridgewood, Long Island, haunted an open-air nickelodeon; and refused to leave at the end of the half-hour show until the manager chased them out, one by one. There was no booth—the projector stood on a table at the rear of the audience and was operated by turning a crank. One day the operator was called to the 'phone, and looking to the small boy nearest him said: "Hey, kid, keep turning this crank for me till I get back."

That was so thrilling an experience that young Muller came back for more of it, night after night. The arm-weary operator had no objections. It's a long, long trail of progress that Muller has shared from that hand-cranked gadget on a table to the immaculate suite of rooms at Rockefeller Center.



Charles Muller (center) chief projectionist at Radio City Music Hall and two members of his projection staff; (left) Joseph Kleinman, and (right) John Tillman.

SCREENS:

From a Sound Engineer's Point of View†

By *H. W. HASTINGS-HODGKINS*

PROBLEMS of providing a bright, sharp picture and crisp intelligible sound of good quality confront every exhibitor. Where, as is most generally the case, the loudspeakers are installed behind the screen and the transmission of sound must take place through the screen to reach the auditorium, the screen requirements for picture and sound are diametrically opposed.

For a bright and clear picture it is essential to have a clean matt surface, sufficiently dense to reflect a high percentage of the light projected upon it. For the best transmission of sound, nothing but the conducting medium, *i.e.*, air, should lie between the loudspeaker system and the listener.

Screen Material

The screen, then, must be a compromise, designed to meet these requirements as well as may be. The usual solution of the problem is to use a screen of light, flexible material—one which is not liable to resonate at audible frequencies—and to improve the sound transmission properties of the material by small perforations which cannot be perceived by the viewer at a reasonable distance.

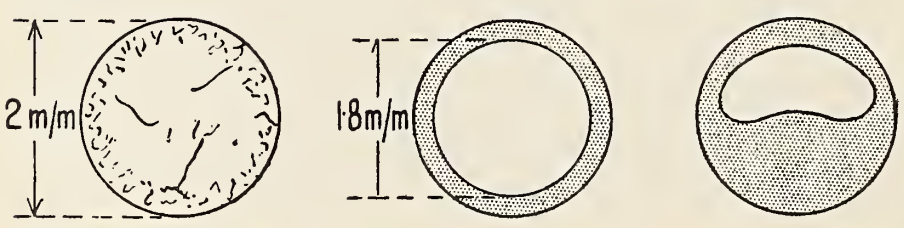
This, of course, is no ideal solution, since much of the sound—particularly at the higher frequencies—is dissipated in the screen material or reflected backwards from it. The loss of sound at low frequencies is relatively unimportant, approximately 4 per cent at 100 cycles, but at the high end, above 4,000 cycles, the percentage rises to 30 or more. This is the state of affairs with a new screen, but when the screen has been "treated" a number of times, the loss at high frequencies is very much greater.

† Ideal Kinema, May 1945.

The fact that these losses do occur can be checked very easily in a theatre where the screen is suspended on "lines" and can be flown. A record should be played through the sound system, and the screen flown sufficiently to expose the speaker system to view. Note should then be taken of the high-note response, *i.e.*, the definition of speech, the "edge" on the brass instruments, etc.; when the screen is dropped again the loss of much of these "highs" will be strongly marked.

As is remarked above, this is the state of affairs with a new screen. Unfortunately, screens need to be "treated" or sprayed with a white composition after a few months' use owing to discoloration resulting from smoke and dust in the atmosphere. This treatment gives rise to two effects on the screen as regards its suitability for the transmission of sound. In the first place, the screen becomes heavier and more dense and the absorption co-efficient of the screen material rises. The second and more serious effect is that the actual size of the perforations is reduced. Finally, after a number of treatments, some of the perforations may be entirely blocked and others partially so.

Reference to the sketch will illustrate how this takes place. Figure 1 is a single perforation in a new screen with, say, an internal diameter of 2 millimeters. The free space through the hole is slightly reduced by the presence of "hairs" or end threads in the material. After a few weeks' use, these hairs will have become reinforced by dust particles from the atmosphere. The screen is eventually treated and the hairs and dust particles form an anchorage for some of the screen dope within the diameter of perforation and we get the situation in Figure 2.



(Left) New screen; (center) 20% blocked after one treatment; (right) 80% blocked after number of treatments.

Here we have a reduction in diameter of .2 mils, assuming the thickness of the dope layer to be .1 mil. The original area of the hole was 3.142 sq. mils, and it is now 2.545 sq. mils, a reduction in area of approximately 20 per cent! Taking into consideration that the absorption co-efficient of the screen material has increased owing to the surface layer of dope, we may assume that the overall efficiency of the screen as regards the transmission of sound has fallen by at least 25 per cent with one treatment only.

Half-Closed Perforations

Unless each perforation is completely cleared (almost a hopeless task) each subsequent treatment will increase blocking at an accelerating rate. The holes won't look much smaller, unless they are compared with the perforations in a new screen, but at the rate of a .1 mil deposit of dope in the perforation for each treatment, the effective area of the holes will have been reduced by 50 per cent after three treatments, even if they escape the fate of the example shown in Figure 3, or of becoming entirely blocked.

What this means in terms of high-frequency transmission loss can be imagined. It might be helpful to run a series of tests with used screens, but from figures already to hand it would appear that the loss at frequencies above 4,000 cycles in a screen which has been treated three times would be in the region of 80 to 90 per cent.

The loss of overall volume entailed is not a serious matter, this can be allowed for by the projectionist, but what is serious is that the definition and clearness of speech will be much reduced, to say nothing of an entire lack of "attack," overtones, etc., in the music reproduction.

From all the above, it seems that the kinema manager who insists on a new screen every year has a strong case, especially if his house is in a city or an industrial area and he has to have the screen treated more than once in the 12 months. If a reputation is sought for having "the best sound in the district," the maximum number of treatments allowable for a screen before replacement would seem to be two—from a sound engineer's point of view, even this is one too many.

ALTEC AGREEMENTS

A deal has been closed with A. C. St. John, of Twin Cities Theatres, Centralia and Chehalis, Wash., for Altec service, sound repair and replacements and complete modernization of sound equipment for his service, according to W. E. Gregory, Seattle district manager. The Endicott Circuit of eight theatres in Brooklyn, N. Y., has renewed with Altec for service and parts for sound equipment, and the M & M Theatres, of Torrance and Gardena, Calif., have signed agreements for sound and service and parts.

Guessing

can be expensive



Guessing can be expensive at any time but particularly so today with the present limitations on new projection room equipment and with the uncertainties of replacements. Every projectionist should know the whys and wherefores of his equipment. He should know what to do and what not to do when the equipment fails to function properly—and how to keep the show going until the service inspector arrives at the theatre.

PROJECTIONISTS' SERVICE MANUAL is a complete, compact compilation and a valuable reference work. All items therein are grouped according to classifications and contain sound practical suggestions relating to the many projection room troubles—their causes and how to remedy them.

A copy of this valuable trouble shooter should be in every projection room for instant reference and as a trouble guide. Many I. A. local unions have ordered this book in bulk and placed a copy in each projection room. The price is right —only $3 per copy, postage prepaid. Order your copy now or ask your local union secretary about our special low-price bulk offer.

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IN THE SPOTLIGHT



By *HARRY SHERMAN*

THE 16-mm field is rapidly expanding and threatens to become an important factor in our industry. The advantages of visual education in our classrooms has long been recognized by many schools and colleges throughout the country, and many of the teacher-training institutions offer special courses in audio-visual instruction. Industrial movies, too, have sprung to the fore in the past years, and in the years to come will play an even greater part in spreading good-will propaganda for industry.

This leads to our oft-repeated warnings to the craft to be on the alert for 16-mm showings and to insist, wherever possible, that only IA projectionists run the projection machines. Hence, a thorough grounding in the details of all portable equipment should be a *must* for every projectionist who plans to enter the non-theatrical field. Extra money and opportunities to travel about the country showing 16-mm movies should be sufficient inducement to warrant a greater interest on the part of the craft in this rapidly growing field.

In Chicago, recently, Gene Atkinson, Local 110 business manager, signed contracts with the meat packing outfit, Swift & Company, for the road showing of their 16-mm motion picture, "Red Wagon," which depicts the life of Gustavus Franklin Swift, founder of the firm. The contracts cover sixteen road shows and calls for IA road scale plus $7 per day for expenses for each man. At last reports, we learned that several Local 110 men have already signed up for the picture, the first showing being held in Springfield, Mass. September 7. Gene certainly doesn't let any grass grow under his feet.

● On our recent mid-west trip we stopped off at Detroit for several days to visit with some of the boys. The Houston Mortons and yours truly drove 45 miles outside of Detroit to visit Roger Kennedy at his new farm. Roger, who is 5th IA vice-president and business agent for Local 199, was hard at work painting a fence on the farm—a job he did not relish and for which he showed very little enthusiasm. His visitors that day seemed to take keen delight in his labors and gave him much free and unsolicited advice. Needless to say, Roger ignored all comments and kept right on with his painting job until it was finished.

● Many locals in the Alliance are forming Legion Posts. The idea originated with Charlie Vencill, secretary of Los Angeles Local No. 150, who organized the first one—Dawn Patrol No. 380. The officers of the Dawn Post are Leo Stockewell, *commander;* Clarence C. Huff, *1st vice-commander;* Theodore O. Engler, *2nd vice-commander;* Harry T. Sandy, *adjutant and financial officer;* R. B. Goode, *assistant adjutant;* Harry Henderson, *chaplain;* C. S. Errickson, *historian;* J. P. Harrison, *service officer;* Dave H. Booth, *sergeant-at-arms*, and A. W. Lindstrom, *assistant sergeant-at-arms*. Other locals are expected to follow with similar posts.

● Bill Donnelly, business agent of Minneapolis Local No. 13, has ventured into the night club business, having purchased the Casablanca, one of the city's leading night clubs. Donnelly is employed as an electrician at the Radio City theatre there and at the present time has no intentions of giving up either his job at the theatre or his duties as business agent. All in all it looks as though he is going to be up to his neck in business. Good luck, Bill, any man who tackles so many jobs at one time deserves a break.

REMEMBER THIS EMBLEM



Men and women who are honorably discharged from the armed forces are wearing this button. Remember, they have served our country well, and helped save the things you love—your home, your family, and your freedom.

● The headquarters of Local No. 233, Buffalo, will soon be housed in its own building at 435 Pearl Street. Extensive alterations are being made and a house warming party, we think, would be very much in order. Business agent Bert Rye and president Ben Pinzel have done much to make Local 233 one of the more progressive locals in the 10th district.

● We were deeply grieved to learn of the sudden death of Lew Mumaw, member of Cleveland Local No. 160. Lew, who was only 39, was extremely popular in sports circles, having been secretary for the Cleveland Indian baseball team for many years. He was appointed general manager of the Cleveland Sports Arena several months ago and seemed to be pleased with his new job. His passing was a shock to his many friends.

● Several months ago we printed an item in these columns about a misleading statement appearing in a circular issued by a certain west coast projection school. The statement we objected to referred to the "high wages paid projectionists—up to and as much as $250 per week." In reply to our item, we received a letter from the management of this school and while admitting that the reference to the high wages was greatly exaggerated, disclaimed any responsibility for it. The circulars, we were advised, were printed by the former owners of the school, and that the new circulars issued by the present management changed the wage reference to read "up to and as much as $125 per week."

That is quite an improvement but we would like to know just how many projectionists in this country earn as much as $125 per week projecting pictures. There may be a few isolated cases, such as road men and a few others, but if the management of the school would take the

time and trouble to investigate prevailing wage scales throughout the country they would find that the majority of projectionists do not earn as much as $75 per week *before* deductions.

● Lester Isaac, projection chief for Loew's, Inc., supervised the installation of new equipment at the Nixon Theatre in Pittsburgh in preparation for the opening of the "Ziegfeld Follies." You can bet your bottom dollar that the Nixon can now boast of the best sound in the city.

● On V-J day when most business houses were closed to celebrate the surrender of Japan, theatres throughout the country remained open and did a land-office business. Mr. Exhibitor felt very patriotic that day and hung out the holiday admission price sign. Theatres were jammed and boxoffice receipts zoomed upward. But to the projectionist on the job it was just another day—Sundays and holidays, they are all the same to him—just another work day. A clause in the contract, however, calling for extra holiday pay would remedy that situation and the projectionist, like every other worker, would be compensated in some measure for working on a day calling for celebration.

● Greetings to our old friend, Lieut. Robert (Bobby) Burns, USNR. Officer-in-Charge of Projection at the USN Photographic Science Laboratory, Anacostia, D. C. Bobby Burns, an IA man for the past 36 years and a member of Chicago Local No. 110, has had a very interesting career and one of which he can be justly proud.



Lt. Robert Burns

In 1922 he received his Bachelor of Science degree from the Armour Institute of Technology. He attended the University of Chicago from 1932-1934, completing a two-years' graduate study in electronics and electron physics.

He operated a vocational school for Local 110 and taught electronics to the members. For several years he was sound motion picture engineer for ERPI and RCA, later taking charge of sound engineering problems for the Balaban & Katz string of theatres in Chicago. He "chiefed" television exhibits at the Chicago Century of Progress in 1933-1934, and when "Fantasia" opened at the Apollo Theatre in Chicago several years ago, he was put in charge of operations.

Bobby served on the Chicago examining board for projectionists way back in the early days of motion pictures. In more recent times he acted as technical adviser on IA jurisdictional committees involving controversies between the IA and the IBEW over sound and television assignments. He was appointed a member of the IA West Coast committee in 1940, along with Tom Murtha, Brooklyn Local No. 4, and Sal Scoppa, New York City Local No. 52, later making a comprehensive report to the IA on the committee's findings.

From 1936 to 1942 Burns served as a member of Local 110 executive board, when he resigned and took the post of civilian engineer for the USN. He was appointed Liaison Engineer, Office of Scientific Research and Development (OSR), working out of Johns Hopkins University of Applied Physics Laboratory at Silver Springs, Md. In 1943 he was assigned to Special Projects on Radio and Radar gear in the Bureau of Aeronautics, being responsible for the maintenance engineering problems that arose in connection with airborne radio and radar equipment for special projects applications. His present assignment at Anacostia followed.

Burns is a member of the Society of Motion Picture Engineers and of the American Relay League.

● Houston B. Morton, member of Detroit Local No. 199, resigned from the executive board of the local to engage in the equipment supply business. Morton is very optimistic about his new venture and is confident of making a go of it. We see no reason why he shouldn't as he is very popular in Detroit theatrical circles and enjoys the reputation of being a square-shooter.

● We received a letter the other day from Solly Pernick, former New York City Local No. 1 business agent. Solly, who has been managing a USO unit playing in the Pacific area, writes that he expects to be home about the end of this month. He has received a letter of commendation from General MacArthur on the excellent job he did in bringing entertainment to our boys in the far away places.

● Now that restrictions on projection equipment have been lifted, most theatres in the country will be in the market for new projection room equipment. Projectionists during the wartime years did a swell job in carrying on with worn and obsolete equipment, and now in peacetime they will be called upon to help out in another way.

It is an accepted fact in the industry that exhibitors are not at all technical-minded and know very little if anything at all about the mechanics of their projection rooms. Although the exhibitor signs the purchase order, the final choice of equipment usually rests with the projectionist. He is the man who uses the equipment and he knows better than anyone else whether or not a given product is best suited to the needs of his theatre. Each theatre has its own particular problems that require special consideration, and we believe that every projectionist should make it his business to get as much information as possible about all products so that when his exhibitor seeks his advice on the purchase of new equipment, he will be able to advise him intelligently.

● We were happy to receive a visit from our very good friend, P. A. McGuire (International Projector Corporation), who is now fully recovered from his recent illness and is back on the job as chipper as ever. Mac is known to practically every projectionist in the Alliance, and we can think of no other person in the industry who is so universally liked and respected. He is a familiar figure at many district conventions and often is called upon to address the delegation. Holding a district convention without Mac would be like holding a meeting without a chairman.



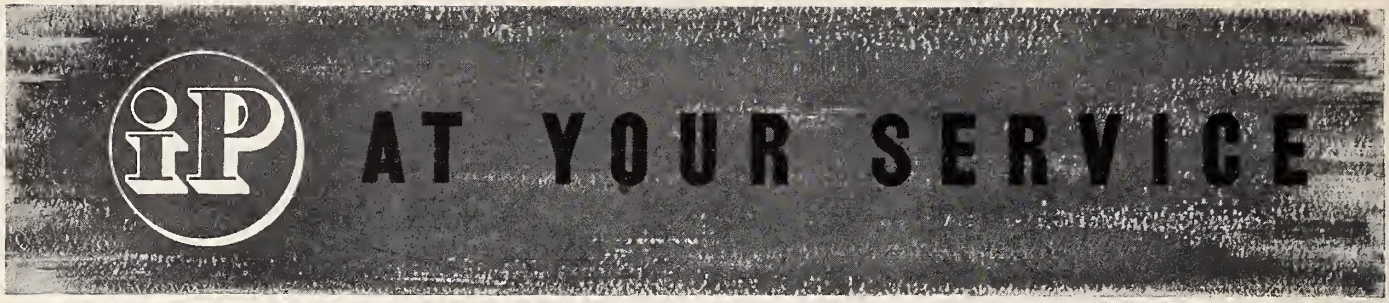
P. A. McGuire

● Last month we spent some time in the Windy City and ran into our old friend, Larry Strong, member of Chicago Local No. 110 and manufacturer of the famous Strong Zipper changeover. Larry is one of the most enterprising guys we have ever met, and is just brimming over with ideas on how to make his product an indispensable part of every projection machine.

● It is with deep regret that we report the death of Mrs. Bert Steinhauser, wife of the secretary of Terre Haute Local No. 373. Although her death was not unexpected, as she was seriously ill for the past year, nevertheless it was a severe blow to Bert. Two children, a boy of 13 and a girl of 11, survive her.

● Elmer Dowell of the U. S. Treasury Department recently paid a glowing tribute to the members and officers of Local No. 110 for their splendid record in the various war bond drives. In an address to the members at one of the local's regular meetings, Dowell stated, ". . . In my experiences with the Treasury Department as a labor liaison man, covering four states and taking in about 21 National and International Conventions last year, the record of Local No. 110 stands out as a national record in the purchase

(*Continued on page* 30)



This department is a collection of random thoughts and some not so random: fact, fancy and opinion relating to the man behind the man behind the gun—the serviceman. The prime purpose of this section is to promote a closer relationship between serviceman and projectionist based on a better understanding of their mutual problems through an exchange of news and views, kinks and kicks. To this end, contributions relative to any phase of the serviceman's activities are invited.

Identifying Wires When Installing Sound Equipment

When additional wires have to be run during an installation, or when replacements are made in conduit, amplifier racks, etc., it is customary to tag the wires with ordinary cardboard price tags. Frequently one or more tags are missing when the run is completed. To eliminate this trouble I would suggest marking the wires with a china marking pencil using your own coding such as one line or dot on each end of a certain wire, two lines or dots on the end of another wire, etc.—R. H. Bisbee, *RCA*.

Pre-Heating of Mercury Vapor Rectifier Bulbs

The five ampere rectifier bulbs used in the exciter lamp power supply units usually increase the output from one-half to one full volt across the exciter lamp load following the initial installation in the socket, and after fifteen to thirty minutes of operation. Consequently, when replacing this type of tube in the power unit it is well to let it run under load for the above period of time before making the final adjustment or checkup of voltages across the exciter lamps.—W. H. Howard, *RCA*.

Correction of Low Amplifier Output

The toughest emergency calls that have come to my attention have been those where the gain and consequent sound coming from the speakers has been low or varying. About fifty per cent of calls handled by the writer have been due to some external gadget hung on the speaker line or output transformer terminals by the projectionist, or some other well-meaning person, without advising the sound engineer. Jacks for plugging in headphones for checking in the projection room, and jacks for headphones for favored partially deaf patrons, are among the most common offenders.

I would suggest that before going through the trouble of checking and testing the equipment in an effort to locate the trouble, it would be a good idea to make a preliminary check for extra gadgets attached to the equipment, particularly in cases of low sound. When these gadgets short the voice line there usually is enough sound coming out of the speakers to fill the house with full gain, which might cause a dead short on the voice line to be doubted until all other possibilities are eliminated.—W. H. Howard, *RCA*.

Protecting Amplifier Components Against Climatic Changes

Since this is the beginning of the rainy season in many parts of the country, especially in the South, particular attention should be paid to hygroscopic materials used in high voltage circuits, such as cotton insulation, dust, carbon ash, etc. I have found resistors and wires carrying d.c. voltage to be staticly polarized in some instances and attracting dust and carbon ash. When this dust or ash becomes moistened by high humidity, especially near the seacoast, noticeable drift can be determined in high values of resistance and noise heard when this occurs in low level circuits. One remedy is to carefully clean the affected parts, then paint them with a solution made by dissolving carnauba or ceresin wax in carbon tetrachloride.

In the absence of good rubber tape engineers may be tempted to use a suhstitute. Being suspicious, I decided to test a piece of dime-store so-called rubber tape. I wrapped a short length around a bar copper wire, let it lay for several weeks then unwrapped it and observed the beginning of that tell-tale green. The obvious conclusion being that some chemical used in its manufacture caused corrosion.

Another piece of the same wire wrapped with okinite and used as a control factor came out clean. This experiment was prompted as the result of a sad experience I had some time ago in using Scotch tape for insulating fine wires in electrical measuring instruments. Corrosion ate the wire completely through in a few months' time. Both Scotch and adhesive tape are very hogroscopic in addition to containing chemical injurious to wire and should never be used for insulation purposes.—Frank Ingels, *RCA*.

Get your copy of

Projectionists'

SERVICE MANUAL

and learn what the service man does when the equipment fails to function properly. Compiled in handy book form and attractively presented.

How to Adjust Film Take-Up of Lower Magazine

In checking take-up mechanisms, I find that most projectionists have too much tension on the lower take-up spindle, consequently wearing down the sprocket teeth on the soundhead hold-back sprocket, prematurely. The reason for not adjusting take-ups too loosely is because a large film loop would gather between the hold-back sprocket and the take-up reel. In adjusting the lower take-ups, the projectionist should first reduce the spring tension until a large film loop forms when the reel is just beginning to take up. While starting and stopping the machine, continue to increase the spring tension until no slack film gathers between reel and hold-back sprocket. This is not only the proper film tension adjustment, but it also reduces to a minimum the wear on the hold-back sprocket. This extra care is an excellent "all time" economy.—S. S. Lebow, *RCA*.

Improving Operation of SH-7500 Soundhead

Noisy gears and low frequency distortion encountered in the operation of the SH-7500 reproduction can be improved by removing the balance wheel on the drive shaft and replacing the drive gear and pinion SH-7001 and SH-2555 with a new drive gear pinion (parts numbers SH-2765 for the pinion, and SH-7047 for the bakelite gear). These gears must be installed as set, as they have a different tooth design and there is a space there to take the place of the balance wheel which is longer than the old one—the SH-2518. The new space is SH-2758, item $28.

This was tried at several installations and removing the balance wheel worked wonders with the low frequency distortion and also corrected a very bad gear noise in both heads.—S. E. Bullington, *RCA*.

Projectionists' Course on Basic Radio and Television

By *M. BERINSKY, E.E.*
MEMBER OF INSTITUTE OF RADIO ENGINEERS

XV—CAPACITANCE (Continued)

CONDENSERS, like resistors, may be connected in series or parallel. When condensers are connected in parallel it is equivalent to an increase in the area of the plates of a single condenser. This means that the capacitance will increase in proportion to the amount of capacitance connected in parallel. In Figure 1 we see two condensers, C_1 and C_2, connected in parallel. The formula for condensers connected in parallel is $C_t = C_1 + C_2 + C_3$, etc. This means that the total capacitance C_t is equal to the sum of the individual condensers, the formula being similar to that for resistors in series.

For example, suppose that a 5 mfd. condenser is connected in parallel with a 6 mfd. condenser. The total capacitance will equal the sum of the two condensers, or 11 mfd.

When condensers are connected in series the quantity of the charge divides between these condensers. This condition is the same as that for resistors connected in parallel because with resistors in parallel the total current divides between them. A series connection of capacitance is shown in Figure 2. The formula for condensers in series is the same as the formula for resistors in parallel:

$$\frac{1}{C_t} = \frac{1}{C_1} + \frac{1}{C_2} + \frac{1}{C_3}, \text{ etc.}$$

When only two condensers are connected in series the total capacitance is given by a simplified formula:

$$C_t = \frac{C_1 \times C_2}{C_1 + C_2}.$$

Let us suppose that the 5 mfd. and the 6 mfd. condensers in the previous example are now connected in series.

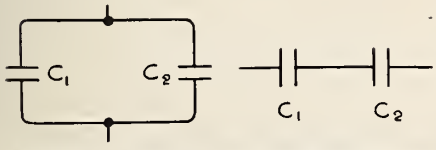


FIGURE 1 *(Left). Two condensers connected in parallel.* **FIGURE 2** *(Right). Two condensers connected in series.*

The total capacitance is best found by using the second formula for capacitance:

$$C_t = \frac{5 \times 6}{5 + 6} = \frac{30}{11} = 2.72 \text{ mfd.}$$

When three or more condensers are connected in series the first formula can be used to advantage. Suppose that three condensers of 10 mfd., 20 mfd., and 30 mfd. are connected in series. The capacitance can be found in the following manner:

$$\frac{1}{C_t} = \frac{1}{10} + \frac{1}{20} + \frac{1}{30} = .1 + .05 + .033 = .183.$$

But .183 is equal to $\frac{1}{C_t}$, and in order to find C_t we must divide .183 into 1.

$$C_t = \frac{1}{.183} = 5.46 \text{ mfd.}$$

Condensers are connected in parallel when it is desired to increase the amount of capacitance in a circuit. In radio work condensers are rarely connected in parallel because it is possible to obtain large condensers. Occasionally radio servicemen will connect two condensers in parallel when their stock of large condensers is depleted and they still have many smaller condensers on hand.

Condensers are connected in series when they are to be used in high voltage circuits and when high voltage condensers are not available. For example, two 600 volt condensers, when connected in series will withstand 1200 volts. In television power supplies containing very high voltages condensers are sometimes connected in series. When condensers are connected in this manner they should be of equal capacitance, otherwise resistors should be shunted across them to equalize the voltage drop across each component.

Condenser Color Code

In the previous article of this series we mentioned that the size of mica condensers is usually indicated by means of a color code that has become standard for the radio industry. This is known as the Radio Manufacturers' Association (R. M. A.) color code and is also used for identifying carbon resistors. In the R. M. A. color code certain colors have been chosen to represent numbers, and these colors and their corresponding numbers are given in Table A.

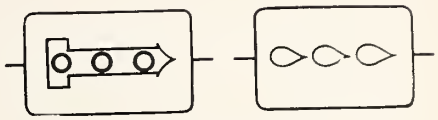


FIGURE 3. *Two methods for color-coding condensers.*

Figure 3 shows two methods for color coding condensers. The colors are read in the direction of the arrows. The first dot at the left represents the first figure in the size of the condenser. The dot in the center represents the second digit in the size of the condenser, and the last dot at the right represents the number of zeros after the first two significant figures. The size of the condenser is then given in micro-microfarads.

As an example, suppose that the first dot at the left is red, the center dot is green and the third dot at the right is brown. Red is equal to 2, green is equal to 5, and brown is equal to 1. The first two significant figures will be 25 and the number of zeros following these figures will be one. The size of the condenser will be 250 mmfd.

Let us try another example. Suppose that the dots read from left to right as follows: green, black, and black. The first figure would be 5, the second figure would be 0, and the number of zeros following these two figures would be nothing. The size of the condenser would be 50 mmfd.

We have seen that current does not flow through a condenser. When a condenser is connected to a source of direct current, a current will flow in the circuit the instant that the switch is closed, but will cease to flow in a very small fraction of a second. When alternating current is connected to a condenser current will flow continuously in the circuit.

Figure 4a shows a source of alternating

current connected to a condenser. For one-half cycle, plate No. 1 of the condenser will be connected to a positive potential and plate No. 2 will have a negative potential. Under the pressure of this voltage, electrons will rush out of plate 1 and rush into plate 2. This will cause the ammeter in the circuit to "kick" because electrons move through it.

If direct current were connected to the condenser instead of alternating current, the electrons would flow only for a short period of time (until the condenser is charged), and would then become zero. Because the current flows for such a short period of time, we say that current will not flow in a circuit containing a condenser which is connected across a direct current.

When an alternating current is connected to a condenser, the polarity on the condenser plates changes periodically. This is shown in Figure 4b. On the second half-cycle the polarity of the alternating current changes. Now, plate 1 is negative and plate 2 is positive. Instead of the current decreasing to zero as it would if direct current were connected to the condenser, it has simply reversed its direction. The ammeter will now "kick" in the opposite direction, so that the flow of current, although periodically reversing in direction, is continuous.

It should be remembered that current does not actually flow through a perfect condenser, because a perfect condenser would contain a perfect insulator. However, alternating current does flow everywhere else in the circuit. This is the same as if alternating current did actually flow through the condenser. For this reason we say that alternating current flows through a condenser.

The current which flows in the circuit does not flow as easily as it would if a wire were connected instead of the condenser. A condenser offers some opposition to the flow of an alternating current in much the same way that a resistor offers opposition to the flow of current. In order to distinguish between the opposition of a resistor and the opposition that a coil offers to alternating current, it will be remembered that the opposition of the coil is called reactance, or more specifically, inductive reactance. In much the same manner, the opposition that a condenser offers to the flow of an alternating current is called capacitive reactance. This opposition is dependent upon the size of the condenser and the frequency of the alternating current and is given by the following formula:

$$X_c = \frac{1}{2 \times \pi \times f \times c},$$

and is also written $X_c = \frac{1}{2 \pi f c}$. Where X_c is the capacitive reactance in ohms, π is a constant equal to 3.14; f is the frequency of the alternating current in cycles, and c is the capacitance of the condenser in farads.

The farad is a very large unit and is never used in radio work, the microfarad, and the micro-microfarad, being the common units. This fact makes the formula above cumbersome and inconvenient to use. A more convenient formula is $X_c = \frac{159.000}{f c}$, where f is in cycles and c is in mfds. This formula may also be used when f is in megacycles, and c is in mmfds.

Still another convenient formula where f is in megacycles and c is in mfd. is the following: $X_c = \frac{0.159}{f c}$.

An example of the use of these formulas will now be given. A 10 mfd. condenser is connected across a 60-cycle alternating current source. What reactance does this condenser offer to the flow of the alternating current? (*Solution*) Since f is given in cycles and c is in microfarads, the first formula should be used.

$$X_c = \frac{159{,}000}{60 \times 10} = \frac{159{,}000}{600} = 265 \text{ ohms.}$$

Let us try another problem. A 250 mmfd. condenser is connected to an a.c. voltage whose frequency is 5 megacycles, In order to calculate the reactance of this condenser the same formula should be used.

$$X_c = \frac{159.000}{5 \times 250} = \frac{159{,}000}{1250} = 127 \text{ ohms.}$$

We remember that the current lags behind the voltage in a circuit which contains a pure inductance. This is due to the fact that in a coil the voltage reaches a maximum value before the current reaches its maximum.

In order to understand the phase relations taking place in a circuit containing capacitance it is necessary to refer back to Figure 4a. Let us assume that the voltage in Figure 4a is d.c. At the instant that the switch is closed electrons rush out of plate 1 and move into the generator. Electrons then rush out of the generator and move on to plate 2. When the electrons cease to move out of plate 1 and into plate 2, the condenser is charged to the voltage of the generator. It should be noted that the current flows first and the voltage appears at some later time. We can say that the current leads the voltage in a circuit containing capacitance alone. The angle by which the current leads the voltage is 90 degrees.

Current Through a Condenser

The current flowing through a resistor is given by Ohm's Law as $I = \frac{E}{R}$. Ohm's Law also applies to alternating current circuits. The current through a condenser is given by the following formula: $I_c = \frac{E}{X_c}$. Where I_c is the current in amperes flowing through the condenser, E is the voltage across the condenser, and X_c is the capacitance reactance in ohms. Suppose that the voltage across a condenser is 120 volts and the capacitive reactance is 10 ohms, the current in the circuit will then be equal to 120/10 or 12 amperes.

TABLE A

R. M. A. Color Code

Black	0
Brown	1
Red	2
Orange	3
Yellow	4
Green	5
Blue	6
Violet	7
Grey	8
White	9

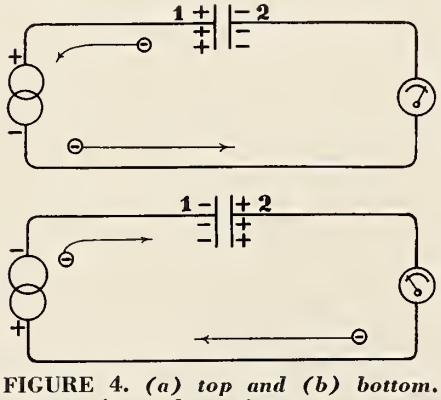


FIGURE 4. ***(a) top and (b) bottom. Action of an alternating current on a condenser.***

AUGUST QUESTION AND CORRECT ANSWER

1. (Q.) A parallel plate condenser has 4 plates, each one having an area of 600 square centimeters, and its dielectric has a constant of 5. The thickness of the dielectric is .25 centimeters. Find the capacitance of the condenser in mmfds.

(A.) 3185 mmfds. or .003 mfd.

SEPTEMBER QUESTIONS

1. What is the total capacitance of a 12 mfd. condenser connected in parallel with a 6 mfd. condenser?

2. What is the total capacitance of the same condensers connected in series?

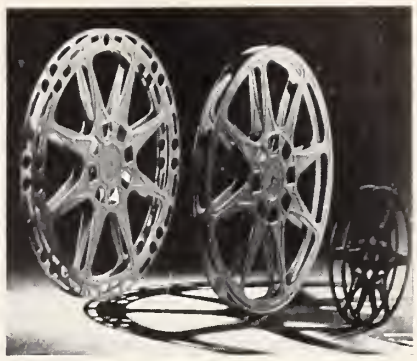
3. What is the capacitive reactance of a .01 condenser at 10 kilocycles?

The answers to these questions will appear in the next issue.

STANDARD REELS FOR 16-mm FILM

By *D. F. LYMAN*

EASTMAN KODAK COMPANY



Three of the standard size reels for 16-mm film.

Because of increasing interest in the 16-mm field, this article which appeared in a recent issue of Industrial Standardization, house organ of the American Standards Association, is presented to the readers of I. P. The author, Mr. Lyman, was chairman of the subgroup appointed to recommend standards for a 2,000-foot reel for the 16-mm projector.

DURING the preparation of the American War Standard for a service model 16-mm sound projector, Z52.1-1944, A. G. Zimmerman, chairman of Subcommittee D of the War Committee on Photography and Cinematography appointed a small subgroup to consider and recommend standards for a 2,000-foot reel for that projector. Included on this committee are members of the Armed Forces and representatives of the 16-mm industry.

As the work of this subcommittee progressed, its scope was increased, and as they were completed the proposals were, therefore, submitted for criticism to larger groups of service and industrial organizations than those originally represented on the committee. The final result is the American War Standard Specification for 16-mm Motion Picture Production Reels and Containers, Z52.33-1945, now ready for distribution to all who may be interested.

In considering certain specifications it is interesting to analyze the motives of the committee and to describe the whys and wherefores of its action, rather than to list the contents in detail. That is true here, for the standard itself gives no hint of the reasons for some of the specifications.

The main reason for the increase in the scope of the work was that a preliminary examination of previous standards for reels revealed the necessity for extensive revision. Furthermore, the committee found that many of the dimensions specified for the 2,000-foot reel were also applicable to the whole line of reels commonly used on 16-mm projectors. For this reason the new AWS Z52.33-1945 covers not only the 2,000-foot reel but also reels and containers of the following capacities: 200-feet, 400-feet, 800-feet, 1,200-feet, and 1,600-feet.

Here, in the film reels and containers, is a product that is particularly suited to standardization. Sixteen-millimeter film is so well standardized that there is no reason why its vehicle cannot also be standardized. Moreover, it is essential that reels of different manufacture fit projectors of all types, so much so that if there were no standard, manufacturers would have to follow an unwritten one, or utter confusion would result.

In all these war standards the needs of the Armed Forces come first. Fortunately, most of their requirements are for the best interests of the commercial trade also, and that is true in this case. From the standpoint of the Services, then, what constitutes a satisfactory reel?

First, the Services have their own ideas about materials and the finishes applied to their products, also the rigors they will have to withstand. This aspect is covered in the usual manner in this specification, as are questions of general workmanship, welding, and riveting.

Reel Dimensions Considered

As for the dimensions themselves—and they are grouped into one table under an explanatory drawing—the first question in which the Services are interested is whether the reel will fit the projector. If there is radial clearance for the reel, the primary consideration is the fit of the reel on the spindle. Therefore, the sizes of the round and square holes in the flanges lead the list. This round-square construction was made mandatory because the Services believed that it would give them some measure of fool-proof projection.

It would make it more difficult for the projectionist to place on the supply spindle a roll of film that had not been rewound and thus produce the well-known upside down results. It was not necessary to change the dimensions given in the previous standard for the round and square holes because investigation showed that they were satisfactory for practically all the 16-mm projectors placed on the market.

When it came to the width of the reel, particularly the distance between flanges, the Services wanted a dimension that would insure smooth winding of the film without interference between the film and the flanges. Thus, the limits of the width should be from slightly greater than film width to the greatest width permissible from the standpoint of smooth coiling. It has been found that if the width of the reel exceeds certain limits, the film wanders laterally so that the sides of the coil



Motion picture reels and containers had to operate under all service conditions in order to meet the requirements of the Armed Services. The photograph above shows 16-mm motion picture projection equipment being set up to give entertainment to men in one of the theatres of war.

are rough. More serious, the diameter of the complete coil is excessively large so that it often exceeds the diameter of the reel, especially if the film is curled or buckled slightly. For the first time, this standard calls for different tolerances in different zones of the reel.

Greatest Variation at Periphery

It is recognized in this standard that the width at the periphery of the flange is subject to the greatest variation; therefore the tolerances are more generous, but they are still within the criterion mentioned above. Such wide limits are not necessary at the core; there the limits can be much closer without imposing too much of a handicap on the manufacturer. Then a third tolerance, for the dimension adjacent to the holes for the spindle, is slightly larger because the flanges may be bowed a trifle near the center. This last figure is important because it has a bearing on the performance of the devices that align the reel on the spindle and hold it there.

Previous standards and common usage had a great deal to do with the dimension for the outside diameter of the flanges. Past practice was important because projectors had been designed to accommodate certain diameters, and if these diameters should now be exceeded, the reels would interfere with the projectors optically or mechanically, or they could even interfere with each other.

When the sizes of the cores or hubs were considered, the committee agreed that they should be made as large as the outside diameter of the flanges would permit for the length of film in question. This is desirable because with the constant-torque type of take-up mechanism employed on many projectors, the tension on the film varies inversely with the radius of the coil; therefore it is too high at the core of the reel if the core is too small.

Rather generous negative tolerances are given in some cases because it seemed impracticable to ask manufacturers to scrap tools for current reels when the ratio of outside diameter to core diameter was within reason. A ratio of 2 would be desirable, but in view of the limitations imposed by common usage on the outside diameter of the flange, in some cases the ratio is about 3. A footnote states that a later revision of this specification will omit the negative tolerance. In this way the industry is urged to change to the larger nominal dimensions, at least when it has to replace tools.

Other aspects of performance desired by the Services are included in the standards for lateral runout of the flanges and concentricity of the flange and the core. For the convenience of the projectionist, several paragraphs specify the frequency and location of footage marks, the size and number of the core slots to receive the end of the film, the accessibility of the slots, alternative methods of securing the end of the film, and the provision of finger holes in the core area of the large reels.

Weight an Important Factor

In these days of air transport, weight is an important consideration; a maximum is specified for each size. But light weight must not be attained at the expense of adequate strength; therefore, a test is provided to determine the amount that the flanges spread when they are pulled apart with certain forces. Another paragraph stipulates that the flanges shall return to their original positions—within certain limits—after they have been squeezed toward each other a given distance, in most cases until they touch each other.

Of importance to the Services is the standardization of the container for the reel. Once the outside diameter and



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OUTLINES PLANS FOR ANNUAL EXHIBITS OF EQUIPMENT

H. F. Wendt, of the Wendt Advertising Agency, Toledo, in outlining a plan to simplify the exhibition and demonstration of products to theatre owners and distributors and at the same time eliminate many inconveniences and abuses which have attended some procedures in the past, points out that he is taking the initiative in the matter at the request of a number of equipment manufacturers.

He proposes, briefly, that exhibitions, or miniature fairs of complete theatre equipment, building materials and furnishings be held annually in three cities which would be within convenient reach of all those interested. The dates of the events would be made to coincide as nearly as possible with those of the principal film producer, exhibitor and supply dealer conventions, and efforts made to have the locations also coincide. Other than such coincidence of place and date there would be no connection with other meetings.

Mr. Wendt points out that the plan would eliminate the necessity of manufacturers attending and displaying merchandise at numerous State theatrical trade conventions and the costly procedure of publicizing their equipment in connection with such events. In this instance there would be only one item of expense and this would be pro-rated among the manufacturers involved.

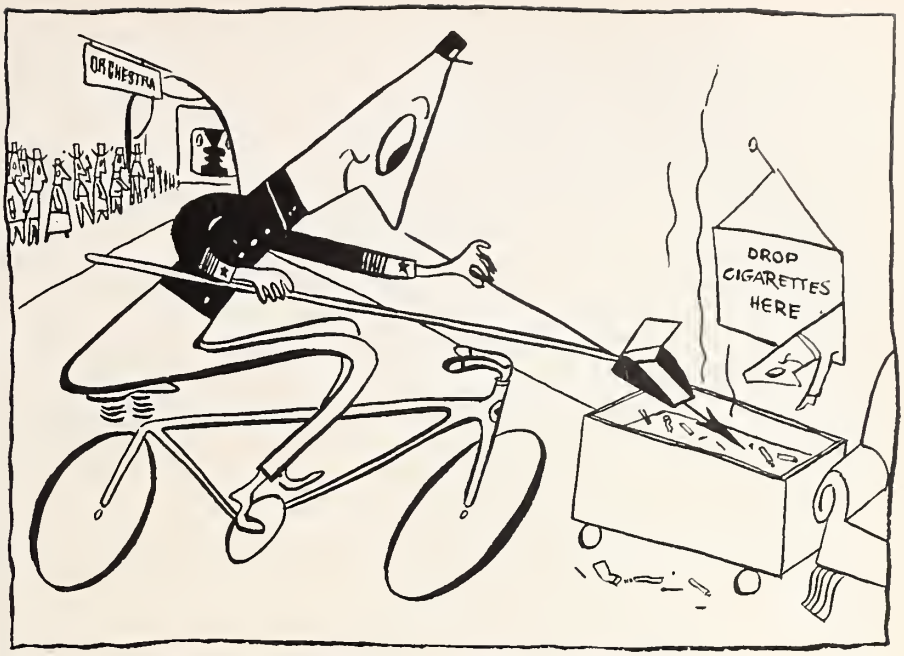
SEELEY RETURNS TO ALTEC

E. S. Seeley, who since September, 1941, has been on special leave of absence from the engineering department of Altec Service Corporation to Columbia University on war projects, has returned to the company as development engineer, according to an announcement by C. S. Perkins, manager, commercial engineering of Altec. Mr. Seeley is a graduate of Cornell University, with the degree of electrical engineer, and was first associated with Altec in 1937 after ten years with Electrical Research Products.

the width of the reel are established, the size of the container can be set. Then the projectionist will not be placed in the predicament of not being able to fit the projected film into a container because the container is too small.

Other aspects of the container included in the standard are: embossings for strength, areas for labels, nesting for stacking, strength, and rolled edges that enable the Service projectionist to open the container without the use of tools. Strength is covered in two paragraphs that specify the minimum thickness of the metal of which the can is made and a test of the resistance to damage when the loaded container is dropped. It is not expected that the container and reel will escape deformation in this test, but it is specified that the damage to the reel shall not be so great that it cannot be straightened with pliers so that the show can go on.

While any project of this type is bound to contain compromises, the subgroup believes that this specification will prove to be a step ahead in the general program of standardization of those things that particularly need standardization.



Sound Equipment Needs Attention, too!

YOU don't let dirt or refuse accumulate in your lobby—you should be just as particular about the condition of your sound and projection equipment. A breakdown could mean serious loss of business. Trouble is prevented when you contract for RCA Service — a periodic checkup that maintains old equipment at peak performance and keeps new equipment in top condition.

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"There's a Branch Near You"

Jap Films Boycotted in Manila

Henry C. Lolliot, RCA International Division representative, who recently was received at headquarters in Camden, N. J., as "returned from the dead," detailed to company executives how the Japs tried to promote Japanese films in Manila theatres during their occupation of the Philippines, but found that people refused to patronize the theatres and finally had to go back to the showing of American films.

"When the Japs came to Manila," Mr. Lolliot said, "a Japanese cinematographic firm, the Eiga, took over all the American distributing companies as well as all the stock of motion picture theatre supplies, and started doing business. The percentages paid by the exhibitors were pretty much the same as pre-war rates, but one thing I never discovered was how much the Japanese Army, who in the first place had stolen all the film and equipment, received as 'commission.'

"For two years, American pictures, partly censored, ran and attracted to the theatres great crowds of people, who in spite of the failure of most of the air conditioning plants, flocked in to get a glimpse of the ways of American life, which had been their own, and which the Japanese in their propaganda were trying to describe as decadent and barbarous.

"It was a long time before the Japanese got wise to the fact that there was no substitute for a well garnished table which, when seen on the screen brought sighs of envy and a longing for the old days of plenty, and that their radio and newspaper propaganda was being undermined by the screen.

"Attempts to show Japanese productions were then made. I saw some of them—poor, pitiable attempts at grandeur—with fairly good photography but poor sound. In one picture most of the scoring was stolen from 'Snow White.' The exhibitors tore their hair—so did the Japanese company which had to pay the military—with the result that American pictures came back.

"Local production was also tried and brought amusing incidents," Mr. Lolliot relates. "The Japanese decided to shoot a picture re-enacting the fall of Bataan and in one scene showing the retreat of the American forces through Manila, brought in hundreds of American prisoners in full combat equipment, less ammunition naturally, with tanks, jeeps, etc. The sight of these American soldiers went through the city like wildfire and many Filipinos really believed for a while that the Americans were back. Together with Spaniards, Swiss, and other neutrals the Filipinos rushed the Japanese guards and managed to pass out cigarettes, candy and fruits to the dazed and smiling Americans. There was no shooting that day.

"When the picture was finally screened, with the cooperation of the Jap military police, the Filipinos flocked to the theatres only to have a look at the never-forgotten Americans, and all the propaganda value was lost.

"But the Filipino boycott of Jap films got so bad that Eiga officials for financial reasons had to bring American films back."



VIEWS INDIA MARKET AS LARGE FIELD FOR U. S.

With the people of India being enthusiastic movie fans, and with probabilities that their purchasing power will be increased, that market should be a fertile field for the film industry, according to F. P. Young, manager of the India branch of Western Electric Company, Ltd. "At present there are only 2,000 cinemas in India, for a population of over 400 millions," Mr. Young, who has just returned to the United States on leave after five years in India, said. "But all theatres are wired for sound and more than half use American equipment. Native films may run for a surprisingly long time—sometimes a full year."

Mr. Young gives credit to the Indian government for a compulsory educational film program. To improve the education of the masses the government produces films on such subjects as methods of agriculture, industry and hygiene, and requires every cinema to show one of the films on every program.

SMPE PLANS FALL MEET FOR NEW YORK CITY, OCT. 15-17

The Society of Motion Picture Engineers will hold its 58th Semi-Annual Fall Conference, its first postwar session, at the Hotel Pennsylvania, New York City, October 15 to 17 inclusive, it has been announced by W. C. Kunzmann, convention vice-president. A dinner-dance will be held in the hotel's Georgian Room Tuesday evening, October 16. At the dinner-dance the Journal award will be presented to the author of the best paper published in the SMPE Journal during 1944.

The first meeting since the end of the war, it is anticipated that many motion picture engineers and executives who had been engaged in confidential activities for various branches of the Government will be able to discuss wartime developments in the motion picture field and their possible commercial applications.

According to Barton Kreuzer, chairman of the Papers Committee, a number of interesting papers have already been scheduled. "However, there are still openings for other papers," he said, "and members desiring to present papers at the conference should communicate with me at the RCA Victor Division, Camden, N. J."

EQUIPMENT DEALERS WILL HOLD JOINT CHICAGO SESSIONS

Joint sessions will be held by the Theatre Equipment Dealers Protective Association and the Theatre Equipment and Supply Manufacturers Association at the Edgewater Beach Hotel, Chicago, on October 5 to 7. Both conventions are regarded as offering the industry excellent opportunities of viewing new equipment that will be available. At the TEDPA meeting there will be demonstrations of new equipment by manufacturers, regarded as the high point of the gathering.

Both organizations will hold their own business sessions and later will meet jointly to discuss problems that are making themselves evident. Due to lifting of wartime production restrictions it is believed that theatre owners and projectionists will be able to get a broad view of what may be expected in the way of new equipment in the future.

LARGE REPLACEMENTS NEEDED BY FOREIGN THEATRES

Fred H. Hotchkiss, vice-president and general manager of Western Electric Company (France), who has just returned from a three months' inspection trip through western Europe and Africa, declares that about one-fourth of all theatre projection and sound equipment in France, Belgium, North Africa and Italy needs almost immediate replacement. Complete lack of new equipment and scarcity of maintenance supplies during five years, plus some war damage, have placed about every fourth theatre on the critical list, he added.

While abroad Mr. Hotchkiss arranged for considerable work with the Army Service Forces on installation and servicing of motion picture equipment at staging area bases near Le Havre, Rheims and Marseilles, in France.

The present attitude of the French public is most favorable toward American films, he continued, "which have been absent from most French screens for nearly five years. Depending on import restrictions, this would indicate a lively market for not only current or near future film, but also for the better films produced during the war years."



There are countless unsung heroes over this land who go about their jobs, day in and day out, rendering public service so that we can enjoy life—safely, peaceably.

Some, like the "smoke-eaters", risk their lives in the performance of their duty. Others, like the Altec Service Engineer play a major part in maintaining public morale. The million dollar Hollywood spectacle can lose much of its sweep through sound or projection breakdowns. No one knows this better than the Altec Engineer . . . reason enough for his constant vigilance . . . his skill with precision instruments . . . his cooperation with the projectionist.

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THE ORTHOSCOPE LENS

By *HAL HUFF*

H AND H OPTICS

ONE of the most important factors contributing to the enjoyment of motion pictures is the presentation of the picture on the screen. The exhibitor, whether he operates a small neighborhood theatre or a de-luxe house, has but one thing to sell his patrons—and that is Projection. The finest production in the world can be utterly ruined when poorly presented on the screen. It is an indisputable fact that imperfect projection reduces the attractiveness of the finest production; and while perfect projection does not raise the tone of a poor production, nevertheless a poor production properly presented has its good points enhanced while its poor ones are minimized.

Projection today is either an asset or a liability—it either attracts patronage or drives it away. *Good projection is a matter of good business.*

With the idea of perfect projection as a basis to work from, the new Orthoscope lens was developed. This new lens was perfected after considerable time and effort had been spent in research work. The result, however, justified our fondest hopes for with the Orthoscope lens motion pictures may now be presented on the screen in perfect focus, with sharper definition, greater depth, and with a flat field of light evenly distributed on the screen, thereby eliminating dark corners and "hot" spots.

The Orthoscope is in reality two lenses —a negative and a positive lens—which, as a combination, can be inserted in most existing projection optical systems. The negative lens, which is closer to the arc, redirects the converging rays coming from the mirror or condenser so that they become more parallel to the optical axis. These rays then pass through the positive lens near the aperture plate. The action of this positive lens is to focus the crater image much nearer to the projection lens than was formerly possible, thus achieving a closer approximation of what theoretical opticians have long propounded as the ideal condition.

This new lens corrects to a great extent the distortion of pictures when viewed at an acute angle. While it is obvious that some foreshortening must follow because of the angle to the screen, poorly dis-

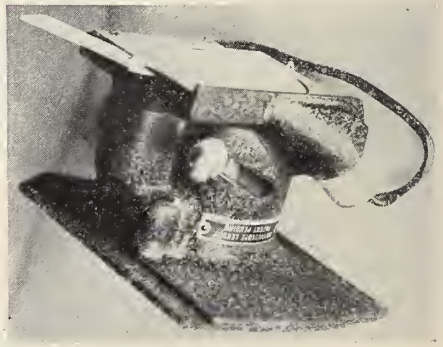
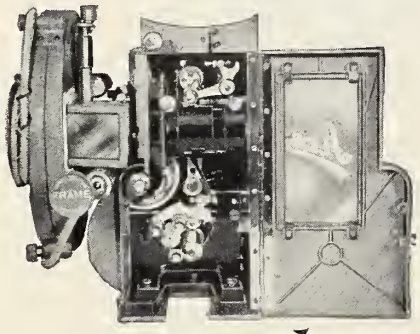


FIGURE 1. *New model Orthoscope lens for the Simplex E-7 mechanism.*

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whose members belong to
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FIGURE 2. *New model Orthoscope lens for simplex mechanisms. This unit consists of lens holder, dowser blade, framing light, and a focusing device. Orthoscope unit may be inserted by removing old spot sight boxes.*

tributed light exaggerates this condition.

Another factor which the Orthoscope has corrected is that of chromatic aberration introduced by the side angle of incidence of marginal light rays on the film. This correction, though desirable in the projection of black-and-white pictures is even more desirable when color films are used, for it is obvious that the addition of color by chromatic aberration to the existing colors of a photographic image gives unsatisfactory results—either in a change in the original color or by introducing slight shifts in contrast and density. The Orthoscope reduces this condition to a minimum and the color picture when projected on the screen is not only brilliant but each color is a faithful reproduction of the coloring on the film.

Despite the increasing demands for a brighter picture, the studios, being more concerned with the *quality* of illumination rather than quantity, request a less brilliant picture. However, with the Orthoscope lens it is possible to project a picture having both brilliancy and evenness of illumination.

The artistry of the cameraman, who in many scenes deliberately vignettes or shades the sides of a picture so as to produce an aesthetic composition, is very often lost or so over accentuated by uneven light when the picture is projected on the screen that the artistic effect strived for is completely ruined. Naturally, the studios want no optically introduced feathering at the time of projection —rightly demanding that this be left to the cameramen.

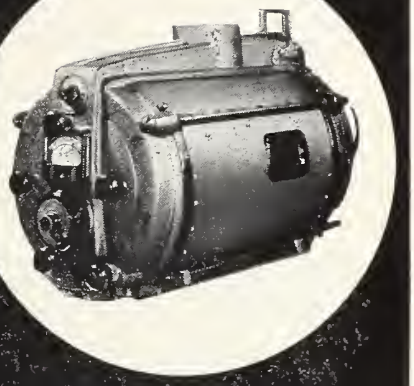
Recently the elements of the Orthoscope lens were coated, resulting in a still further gain in light. Internal light scattering between the lens surfaces was practically eliminated and the color characteristic on the screen was changed to a bluish white light.

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For perfect rewinding on 2000-foot reels.

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WARTIME 16-mm PROJECTOR

(*Continued from page* 10)

then turned on, the image of the aperture centered on the screen, and the projection lens focused. The rewind-take-up lever to the right of the upper sprocket is set at "take-up" and the projector is ready for threading.

Because this apparatus is portable and it may be shifted even if left in one place, or its speaker cable may be disconnected, the above routine with respect to positioning, focusing, and cable connections should be followed in advance of every showing.

Otherwise, operating procedure is fairly similar to that in any theatre. The projector is threaded according to the embossed threading guides. When this is properly done there will be 26 frames from the picture center to the sound pick-up point, as the latest SMPE specifications require. The final point in preparation may be switching on the amplifier, which requires less than one minute to heat up. There are, of course, no changeovers; and film is rewound on the projector but not through the projector—it rewinds directly from the lower to the upper reel.

Should the claw, at any time during operation, fail to engage the sprocket holes of the film, the trouble can be corrected without stopping the projector by inserting a finger in the lower loop—just below the light gate—and bearing down gently to enlarge the loop. When the loop has been restored to its proper size the claw again will engage the film.

Openings of two lubrication tubes are located at the top of the main frame, somewhat to the left of the upper sprocket. Two or three drops of oil should be placed in these every operating day. A film of light grease should be kept on all gears and on the working surfaces of the cams. Every 1,000 hours of operation, a few drops of light oil should be put in the two oil holes of the motor (according to the manufacturer's instruction book); each bearing of the rotary stabilizer should be given one drop of light oil; and all shafts and bearings should be checked, cleaned, and lubricated with a few drops of light oil.

In checking projection and sound results, 16-mm test films should be used. Many 16-mm prints are reduced from 35-mm negatives, and faulty reduction printing may lead to the mistaken impression that the projector is not operating properly. Use of 16-mm check reels and loops will prevent waste of time in searching through the equipment for nonexistent troubles.

TO EXPAND IN 16-MM FIELD

Telefilm Studios have plans for expansion in the 16-mm film field, according to Joseph A. Thomas, president of the company. He said that the new Telefilm studios to be erected immediately in Hollywood would be the most elaborately equipped 16-mm color film and sound plant in the world.

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PROTECTION FOR MANAGERS
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When you open the cabinet, the SWAN automatic marker indicates the reel in use. A simple, practical and inexpensive method for avoiding uncertainty and confusion in removing reels. Easy to install and always reliable.

Set of 12 — $5 **Single unit 50c**

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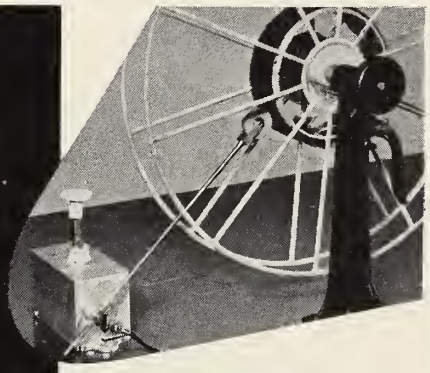
Swan markers are not adaptable for film cabinets with sliding doors.

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Presenting: Ralph A. Root



RALPH A. ROOT, business agent for I. A. Local 236, Birmingham, Ala., became a member of the local in 1912, and has been a pretty busy person ever since for he has widened his union activities to the extent that he has become one of the outstanding figures in the State in union affairs. This month he celebrates his initial half century in this world, having made his first appearance in October, 1895, in Chicago, Ill. Four years later his family located in Utica, N. Y., and when he was twelve years old his family settled in Birmingham, Ala., where Ralph has been content ever since.

Local 236 was organized in February, 1912, and Ralph Root's name went on the roster the following June, occupying an honored place since then. He served with the U. S. Army during World War I, but as soon as he was discharged he again entered the projection field. He has been business agent for the local for over twenty years (he lost track of the exact number) and has attended many I. A. and 7th District Conventions. He served as first vice-president of the Alabama State Federation of Labor for several terms, and for a number of years was treasurer of the Birmingham Trades Council (central trade body). In addition he has been a delegate to the "Big 5" Conventions. He helped to reorganize the "Big 5," which is composed of I. A. locals in Atlanta, Knoxville, Chattanooga, Nashville and Birmingham.

Among Root's other activities, he helped to organize Local 236-A, the colored projectionists' local in Birmingham, and Local 537 in Jasper, Ala. More recently he was active in organizing Local 793, Huntsville, Ala. He has been a Mason for the past 25 years, and is a member of Zamora Shrine (Birmingham), and is on the degree team. Also, he is a member of General Gorgas Post No. 1, American Legion.

He is the father of two children, Ralph, Jr., and Gloria. Ralph, Jr., who is 20 years old, served 18 months with the 15th Air Force in Italy and is now somewhere in the Pacific area. Gloria, 23, recently married Lieut. Frank Savoldi, serving with the U. S. forces in the Pacific. Gloria, by the way, is a writer and is active in the newspaper world, being connected with the Associated Press in Louisville, Ky.



Gradual deterioration of projector arc lamp reflectors results in a corresponding loss in efficiency. Since the only light which can reach the screen must be reflected by the mirror, the loss in screen light is in direct proportion to the loss in mirror efficiency.

Endeavoring to make up this light loss through the use of more current represents a pure waste in the form of unwarranted power bills. Periodic mirror replacement accordingly is a good investment.

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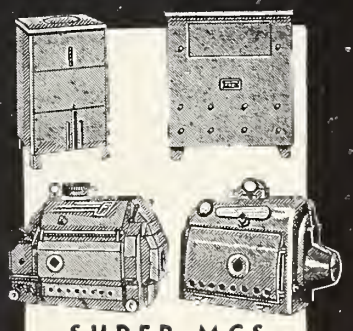
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IN THE SPOTLIGHT

(*Continued from page* 17)

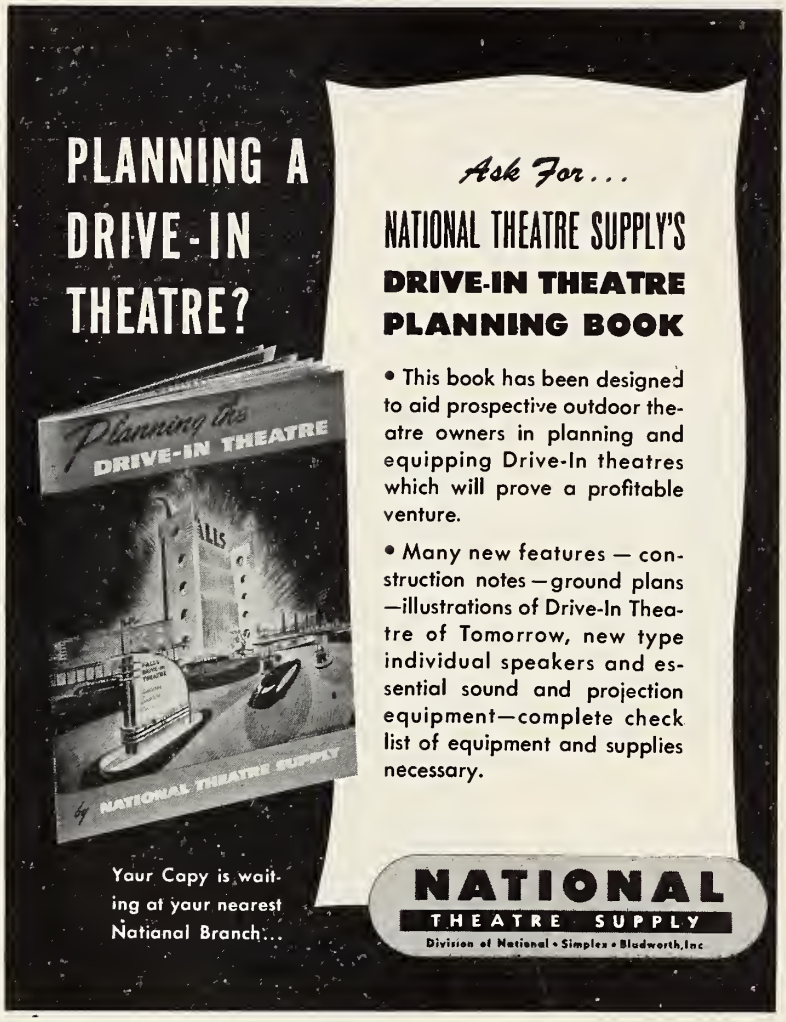
and sale of war bonds. . . . Out of 42,000 local unions in the various National and International Unions in the AFL, your organization, as far as I can ascertain from all of our field representatives, stands out as NUMBER 1 in the National. . . . I think it is a great tribute to the fine leadership in your organization and the loyal and patriotic spirit of the membership of Local No. 110."

Take a bow, Messrs. Gorman, Atkinson, Jalas, Bebb and all the others who worked so hard and gave so unstintingly of their time to help Uncle Sam in his time of need.

● While in Chicago last month we also ran into Harry Mayer, member of Local No. 306, and service engineer for Altec, and J. B. Pesek, member of Local No. 110, and serviceman for RCA Service Company.

● We regret to report the death of a real old-timer, Ernest Clark of Local No. 15, Seattle, Wash. Ernie was a solid bulwark of the IA in its early days of organization, and he remained a staunch unionist until his death. We saw him last at the St. Louis convention in 1944 and although he was well on in years, he appeared to be in robust health. To his family we extend our condolences.

● With the exception of a few hold-outs, St. Louis Local No. 143 successfully concluded negotiations with local exhibitors for a $10 increase for the membership, to be spread out over a period of six years. In addition to the increase, the exhibitors agreed to a two-week vacation with pay. The hold-outs are the smaller independents who refuse to grant the increase on the ground that it is out of line with the present scale in their theatres. Local 143 officials, however, are confident that these indies will soon come to terms.



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New Products

WEBER MACHINE CORP. OFFERS NEW EQUIPMENT

The Weber Machine Corporation, Rochester, N. Y., is offering to the industry two new pieces of equipment—the Syncrofilm Syncro-Dynamic Theatre Sound Projector, and the Syncrofilm "400" Dynamic Soundhead.

According to Carl M. Weber, president of the Weber Machine Corp., the projector is the first theatre projector to be placed on the market which combines the requirements of modern sound and projection in one unit. It has been designed, he states, to combine sound and projection in one unit and as a complete unit to show modern sound film. The new projector, it is pointed out, is not a modification of the silent projector with a built-in sound unit, but is a complete new projector incorporating the latest developments in both sound and projection. Many other features, including a new dynamic filter, new cylindrical lens optical system and new sound sprocket are incorporated in this projector, stated Mr. Weber.

The Syncrofilm "400" Dynamic Soundhead is said to combine the latest developments in the field of sound reproduction, and its outstanding performance, it is claimed, is made possible by a patented dynamic filter which gives smooth motion to the film. "This new principle of sound reproduction," said Mr. Weber, "is one of the outstanding achievements of the engineering staff of the Weber Machine Corporation."

The features of this new soundhead are patented or have patents pending.

NEW SWAN FILM CABINET MARKER BOON TO PROJECTIONISTS

A clever little gadget invented by a practical projectionist for his brother craftsmen seems to be the answer to many a projectionist's prayer. The Swan Automatic Film Cabinet Marker, a simple, practical, and inexpensive method of eliminating all uncertainty and confusion in removing reels from the film cabinet, has proven its worth in a seven months' trial period in a number of theatres throughout the country.

Placing the wrong reel in the machine is the bug-a-boo of every projectionist. Projectionists have used bottle openers, pieces of paper, and other makeshift contrivances as reminders of which reels have already been run and which are yet to run. At best they are unsatisfactory and unreliable.

The Swan Automatic Film Cabinet Marker eliminates all uncertainty for it is a permanent fixture attached to the door of the film cabinet and is fitted with a numbered card, indicating the number of the reel in that particular slot. The marker is so constructed that it may be turned downward when a particular reel is to be eliminated for certain runs and returned to place whenever desired.

This marker is put up in sets of 12 for $5, or single units may be purchased for 50c each.





Do you know what it means to be HUNGRY?

Refugee children do. They know real hunger, bitter, maddening, day-after-day hunger.



Can you know a child's UNHAPPINESS?

Neglected children, "war babies," youngsters in trouble . . . can you put yourself in their places? Can you feel in your heart the tragedy of an unhappy childhood?



Ever been HOMELESS?

Families of brave people — friends who fought on our side—are wandering aimlessly today. Going home? They have no homes!



Have you ever been really LONESOME?

Can YOU feel the bleak, hard loneliness of a soldier stationed on an island outpost far from the war fronts? Yes, YOU?



Can you imagine spending months in a HOSPITAL ROOM?

Thousands of soldiers have to *live* it, the cruel loneliness, the awful boredom.

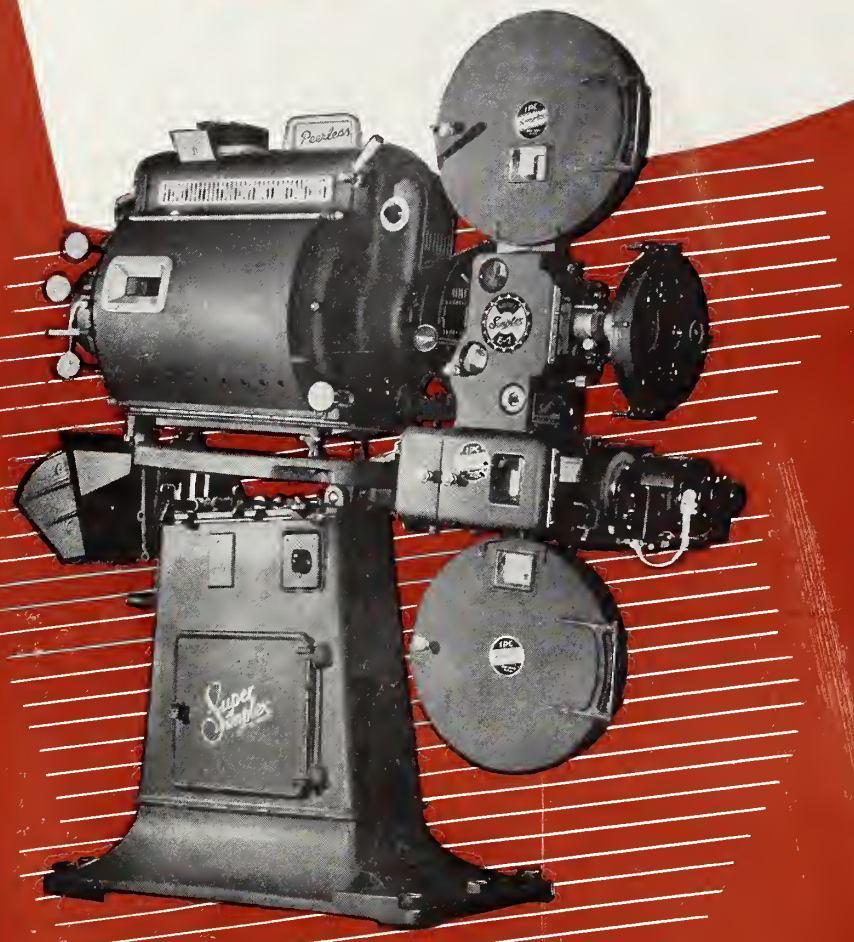
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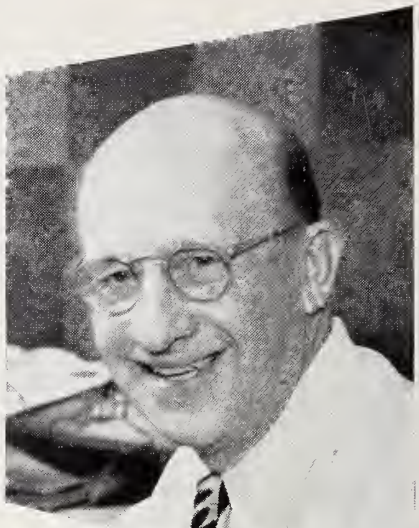
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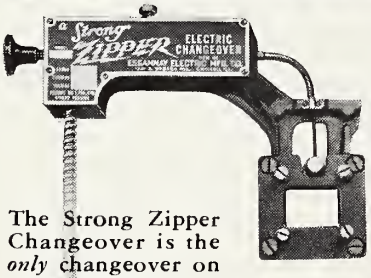
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can be expensive

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INTERNATIONAL PROJECTIONIST

With Which Is Combined PROJECTION ENGINEERING

W. L. Lightfoot, *Associate Editor*

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MONTHLY CHAT

THE PARAMOUNT position occupied by projectionists in the theatre world today was brought out conclusively this month in Chicago where conventions were held by the Theatre Equipment Dealers Protective Association and the Theatre Equipment and Supply Manufacturers Association. Equipment displays at the Edgewater Beach Hotel, as well as at factories and supply houses showed the pivotal part the projectionists have played and are playing in the advances in the industry.

It is highly interesting to report that manufacturers fully realize the central position occupied by projectionists, the only ones in theatres who understand fully the technical problems involved in keeping the show going. This fact was focused upon the mind of everyone attending the Chicago gatherings.

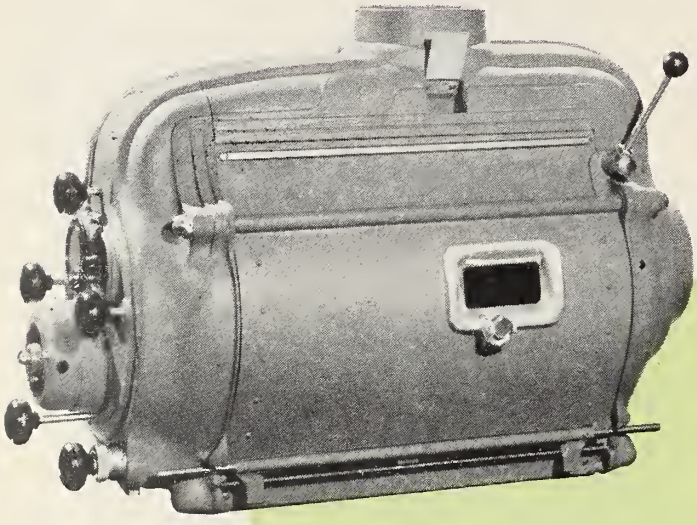
At the displays the many projectionists on hand were the center of attention by those in charge of the exhibits. This is because the principals and their employes realize that when everything is said and done by the non-technical workers in theatres the final decision on the purchase of new equipment is turned over to the projectionists, who know what is what, and who for the most part have originated every new idea incorporated into equipment now in use and new models that will make their appearance as the post-war process enables producers to catch up with the backlog of orders to replace items that have done double and triple duty during the war period.

It is also interesting to note that many items shown in the displays were sponsored by individual projectionists who, alert to the continuing need for progress in the projection rooms, have turned to the production of their own ideas. This is a continuation of the trend of the past, with such items now in daily use in most houses throughout the country.

Theatre owners and managers, as well as the equipment manufacturers, long have depended upon the weighted, practical opinions of projectionists, the key men in every movie house in the nation. When management discusses new items with manufacturers it can nod wisely and maintain an alert attitude, but when the time comes to sign on the dotted line, the projectionist is the man who actually says "yes" or "no." This, of course, is a practical course for management to follow, for it knows that the projectionist, even though he is more or less kicked around in the general scheme of things, is anxious to keep the show running smoothly every minute, and he is the only one in the theatre who actually knows what is needed to achieve the end sought.

The post-war era, already well advanced in our industry, will find the position of projectionists even more secure than in the past.

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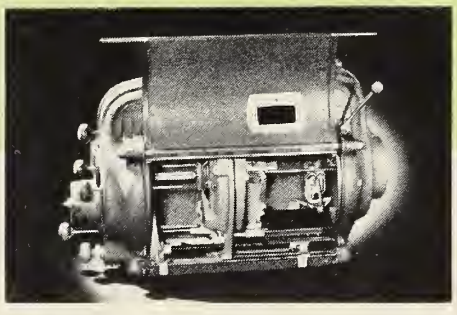
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INTERNATIONAL PROJECTIONIST

VOLUME XX OCTOBER 1945 NUMBER 10

Some Elements of Projection Optics

By *LEROY CHADBOURNE*

The basic elements of projection optics are presented here as a review for the old-timer, and an introduction for the beginner. The ray theory of light is used throughout as the basis of the simplest and clearest explanation of common optical phenomena.

PROJECTION essentially is a matter of optics. All the mechanics of the profession, and a very large part of the electrical techniques, are essentially subordinate details which exist to enable the optical apparatus to perform its work efficiently.

Both in the projection of the picture on the screen and in the projection of the sound track on the photocell, optical principles and practices constitute the core of the entire operation.

A large part of optical results is achieved by means of lenses. Figure 1 illustrates the simple types of lenses most often found in the projection room, either singly or as elements of a compound lens assembly. The shaded portion of each illustration in Figure 1 is the lens; the interlocking circles, etc., illustrate how the lens shape is obtained.

For example, A of Figure 1 is a biconvex or double convex lens. The piece of optical glass out of which it was made is ground as if each side consisted of a portion of glass ball. When both sides have been so ground the shape of the resulting lens resembles the shape that would result if two balls, or spheres, could be made to interpenetrate as shown in the diagram.

On the contrary, D of Figure 1 is ground as if one side were a portion of a glass ball, and the other side flat; D is, therefore, a plano-convex lens.

B and E of Figure 1 are concave lenses, B being bi-concave and E plano-concave.

C of Figure 1 is a meniscus lens, from a Greek word meaning "little moon," convex on one side and concave on the other, ground as if it were the result of the interpenetration of a large glass ball by a smaller one, as shown in the drawing.

Converging, Diverging

Lenses either converge or diverge light. That is, if light passing through a lens, under normal circumstances, tends to collect into a point as a result of the action of the lens, the lens is converging. If light is scattered by the action of the lens, it is called diverging.

The two are readily told apart by looking at them; if the lens is thicker at the center than at the rim, it is converging—hence, A, C and D of Figure 1 are converging lenses. B, E, F of the same figure are thicker at the rim than at the center, and are, therefore, diverging lenses (F is a diverging meniscus lens).

Lens Action

In the design of a photocell and in the designing of lenses, different theories as to the nature and action of light are used by engineers. There are several theories as to the nature and action of light. All are "true" in the sense that practical and useful apparatus can be built by means of these theories, and could not be designed without their help. But the theories don't completely agree. Until science clears up this matter all technicians in the field of optics use, and must use, whatever theory gives the best results for the particular work they are trying to do.

For the purpose of general understanding and clear description of the action of lenses on light, it is generally agreed that the ray or beam theory of light is most helpful; and it will, therefore, be used in the remainder of this article.

A chink in a shutter or blind will let a single ray or sunbeam into a darkened room; the flood of light that enters when the shutter is opened may be regarded as an unlimited number of such rays or beams of light entering side by side.

If the light comes from a small point—

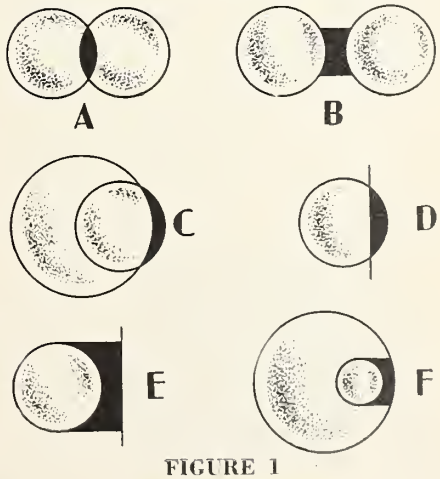


FIGURE 1



FIGURE 2

such as the crater of a carbon arc—the rays of light will naturally spread out in every direction and, therefore, will be inherently, and without action of any lens, diverging rays of light.

If the light comes from a large and remote source, such as the sun, those rays of light that reach the earth are effectively parallel to each other. No lens or mirror is needed to make them parallel.

Now, if parallel rays of light pass through a converging lens, the action of the lens will be to converge them to a point, or focus. The rays will come together at the focal distance of the particular lens in question. This action is diagrammed in Figure 2.

The action is reversible. If a point source of light is placed at exactly the focal distance from a converging lens, the action of the lens will be to make the rays parallel rays after they leave the lens. Each lens has its own focal distance, according to its curvature.

Conjugate Foci

Assume a point source of light is located, in Figure 2, farther away from the lens than point F of that figure. Then the rays of light after leaving the lens will not be parallel to each other, but will converge into a point, or image of the original. The place where the point source is located, and the place where the image point is located, are called the conjugate foci of the lens.

To the contrary, if the point source is moved nearer to the lens than F, the rays of light will not converge on the other side of the lens, even though it is a converging lens: they will diverge instead. All this is made plain by Figure 3.

The heavy horizontal line in A of Figure 3 represents the optical axis of the lens, and the axis of the optical system involving that lens. A vertical line is drawn through the lens, crossing the optical axis at the lens optical center.

Now along the optical axis four points are marked, 2F and F at the left of the lens, and again F and 2F at the right of the lens. F is the focal distance, which is the same at either side of the lens, the action being reversible. 2F is exactly double the focal distance. The arrow drawn at the extreme left of Figure 3A may be taken as an image to be enlarged, or the tip of the arrow may he considered a point source of light.

Referring to Figure 3A, if the arrow is further from the lens that 2F, the rays of light will be brought to a point, an image, on the right side of lens somewhere between F and 2F. The location of the arrow and the location of the image formed on the right side of the lens are conjugate foci.

If the arrow is placed exactly at 2F (Figure 3B) the image on the right side of the lens will be formed exactly at 2F. If the arrow is placed between 2F and F (Figure 3C) the image will be formed beyond 2F. Also, if the arrow were placed at F, no image would be formed except at infinite distance—that is, the rays of light would emerge from the lens parallel to each other, as in Figure 2.

If the arrow is placed closer to the lens than F (Figure 3D) the rays of light will diverge as they leave the lens. No image will be formed at all; but there is a "virtual" image formed at V.

A simple and useful formula will show where the image (not "virtual image") will be formed in each case: $1/od + 1/id = 1/fl$ where od is the object distance, id the image distance and fl the focal length of the particular lens used.

Projection Lenses

The simple lens action diagrammed in Figures 2 and 3 is based upon bi-convex lenses, as shown in those diagrams. The operation of a plano-convex lens would, however, be exactly the same, and just as much reversible. Bi-convex and plano-convex lenses are widely used as condenser lenses in projection, when they are so located with respect to the point source of light provided by the crater of a carbon arc as to converge the light rays toward the projector aperture.

Concave and meniscus lenses, as shown in Figure 1, are seldom used singly in projection work. They are, however, found in every projection room as "elements" in a compound lens; for the projection lens invariably is compounded out of convex and other simple lenses. The function of the projection lens is to treat a frame of film as if it were the arrow of Figure 3C, forming an enlarged image thereof on the projection screen.

Figure 4 shows the general construction of a compound lens, as used in motion picture projectors. The object of compounding lenses is to reduce optical distortion, or aberration, as it is correctly called.

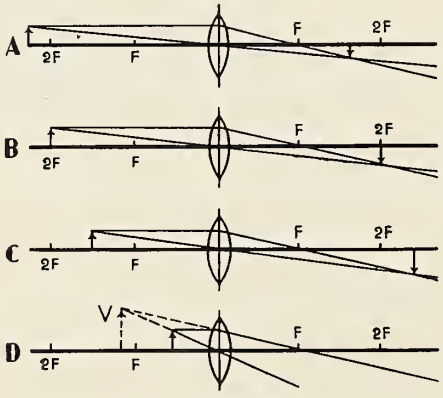


FIGURE 3

If a simple lens, as shown in Figures 2 and 3, were used for projection (it could easily be done) two types of aberration in particular would result. One is called chromatic aberration, the other spherical aberration.

A simple lens tends to break up white light into its component colors—not as thoroughly as a glass prism would do it,

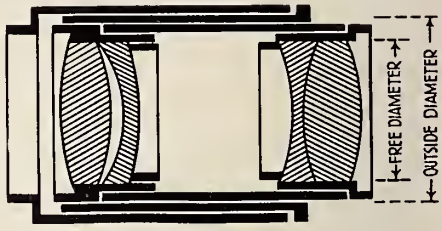


FIGURE 4

but thoroughly enough to create rainbow effects or colored halos, particularly near the edges of the projection screen. A simple lens also introduces distortion of the image, also near the edges of the screen to a large extent.

Lenses of different shapes, and of different kinds of optical glass, produce different distortions or aberrations, and it has long been known that the aberration created by one lens can be effectively cancelled out by an equal and opposite aberration produced by a lens of different shape or different material.

The compound lens does not have a "focal length" as such; each of its components has its own focal length; the compound lens has an "equivalent focus" or E.F. which in practical work so far as the projectionist is concerned amounts to the same thing. Thus a compound lens with an E.F. of 4" behaves exactly as if it were a simple lens of 4 inches focal length—but with far less aberration.

While the designing of complex lenses is no business of the projectionist, but an extremely skilled and complex specialty in the field of optics, it is important for the projectionist to know that the spacing of the elements in a complex lens is critical. Some of the elements are not spaced, but cemented together with Canada balsam. For these reasons a compound lens should not be opened except in extreme necessity, preferably not at all; and great care should be used in applying any cleaning fluid to the outer surfaces, since if such fluid leaks into the assembly it may dissolve the Canada balsam. Then the lens would have to go back to the manufacturer to be re-built.

Projection lenses are commonly rated in terms of their E.F., and an order is placed for a lens of so many inches E.F. In other fields, however, lenses are rated

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according to their "F number," as F-4, F-3.5, etc. The F number of a lens is obtained by dividing the focal length (or the E.F., in the case of a compound lens) by the diameter. A projection condenser lens might be rated that way. If the focal length were 6 inches, and the diameter 4 inches. the F number would be F-1.5.

Mirrors

Spherical' and parabolic mirrors are used to some extent in projection. but the favored form is the elliptical mirror when a point source of light such as a projection arc is located at the primary focal point. Thus, either a mirror or a converging (condenser) lens may be used in a lamphouse. Both are used; in some cases, as in projection with incandescent light sources, both mirror and condenser may be used in the same lamphouse.

Projectionists have no practical problem in ordering replacement mirrors or replacement condensers for lamphouses, since the manufacturer of the lamphouse specifies all particulars, and the projectionist need only order a new mirror or condenser according to specifications. Projection lenses are an entirely different matter, because the choice of a lens depends on the distance to the screen and the size of screen image desired. Since this is a matter of individual requirements, the projectionist must either know how to calculate the E.F. of the lens he needs, or write the facts about his theatre to a dealer or manufacturer, who will make the calculation. But the practical formula is as simple as Ohm's Law, and there is no reason why the projectionist can't do his own figuring on this point.

Ordering Lenses

To determine the E.F. of a lens needed for a given throw and screen image width, a sufficiently accurate formula is given by E.F. = T/W, where T is the throw or distance from lens to screen and W is the width of the screen image. Thus, if the throw were 90 feet and the screen image width 15 feet, the E.F. of the lens required would be 90/15, or 6—that is, 6 inches equivalent focal length.

This simplified formula is not completely accurate, but it is widely used, and is as easily converted into two corresponding formulas as Ohm's Law: thus, $T = E.F. \times W$ and $W = T/E.F.$

Greater accuracy is obtained by using a very slightly more complicated version, in which $E.F. = \frac{0.825 \times T}{0.825 + W}$. This applies only in the case of 35-mm projection, the figure 0.825 being the width of the standard projector aperture in inches. In using this formula T and W should be expressed in inches, not feet.

This formula can also be written in three forms, the other two being: $W = \frac{0.825 \times (T - E.F.)}{E.F.}$ and $T = \frac{E.F. \times (0.825 + W)}{0.825}$.

For 16-mm projection, substitute the figure 0.380 wherever 0.825 appears in the above expressions, that being the width in inches of the standard 16-mm sound projection aperture.

Projectionists are expected to know these formulas and to be able to do the very simple arithmetic they involve; in many jurisdictions this is required in licensing examinations.

For practical purposes, however, charts are available, and even easier to use than the formulas. A chart for 35-mm projection was printed in I. P. for March 1944, page 22. A similar chart for 16-mm projection will appear in an early issue.

Optical Alignment

Let us refer again to Figure 3 and the heavy horizontal lines representing the optical axis of each lens there shown. When several optical elements are combined into a system. they also have an optical axis, and must be aligned accordingly. In projection work the light source, the mirror or condenser, the film aperture and image, the projection lens and the screen constitute one optical system. having a single optical axis on which every part must be squarely aligned.

Instructions for securing correct optical alignment with different types of equipment are supplied by lamphouse manufacturers and by projector manufacturers. These instructions should be followed. and the apparatus checked from time to time to make certain alignment and centering of the several optical elements has not been disturbed by vibration or other factors.

It is always unwise to rely on short-cuts or penny-saving makeshifts in anything that has to do with the optics of projection. If the optical system needs attention or adjustment. sufficient time should be allowed to make the adjustment.

A poor optical system puts a poor picture on the screen. Also it tends to waste light, and projection light is expensive. Defective optical relations with respect to the sound track produce poor sound, and the most expensive amplifiers and speakers can't do anything to improve. The optics at the photocell must be corrected.

It is very unwise practice to try to "get by" with cheap lenses of poor quality, or in poor condition. Nothing is saved: the resulting light loss alone will soon add up to more than the cost of the best lenses.

The advantages of using coated lenses have been repeatedly set forth in these pages. The actual dollars and cents economy, not to mention the improvement in screen results. much more than pays for the cost of such lenses.

New 6AK5 Tube Interests Electronic Engineers

Electronic engineers are showing considerable interest in the 6AK5 receiving type of electronic tube which was designed by the Bell Telephone Laboratories and first manufactured by the Western Electric Company and its subcontractors, the latter company points out. This miniature pentode stems from the 384-A and 386-A tubes designed by Bell for broad-band. high frequency amplification essential to coaxial cable systems, and has played a vital role in military equipment. Its performance is said to promise an even bigger role in the FM and television equipment of the future.

It is pointed out that at the beginning of the war, when circuit engineers of the Bell Laboratories were searching for a small tube to use with high frequency circuits for the armed forces their associates in electronic development offered them an adaptation of a tube which was developed for broad-band carrier systems. This was the 6AK5, and it was found the tube fitted the vital requirements of high transconductance, low capacitances, low noise, and high input resistance. Use of this tube rapidly spread to other equipments until the demand was such that several other companies also were asked to manufacture it.

The 6AK5 is described as a pentode tube with indirectly heated cathode and has the suppressor grid tied internally to the cathode. It is capable of providing better than twice the signal-to-noise ratio that can be realized with any tube previously available for use as an intermediate-frequency amplifier at frequencies of the order of 50 megacycles.

However, the 6AK5 is capable of operating satisfactorily at frequencies up to approximately 350 megacycles. Also, its lower power consumption and smaller physical size proved particularly advantageous to the armed services and, likewise, will help to conserve chassis space for post-war equipment.

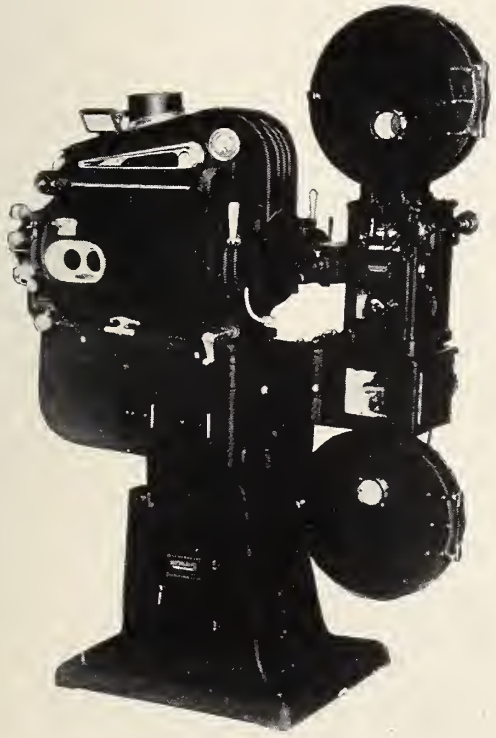
The important characteristics of high transconductance, low noise, and high input resistance of the 6AK5 at the higher frequencies are fundamentally dependent upon the spacing between the cathode and the grid which is in the order of 0.0035-inch. The low capacitances of the tube are said to be another example of this precision technique of using the smallest of elements and eliminating unnecessary metal parts in the tube. Minimum lead inductance has been obtained by mounting the structure close to the 7 pin-button stem.

FRANKLIN T. WOODWARD DIES

Franklin T. Woodward, general patent attorney for the Western Electric Company from 1937 until his recent appointment as consulting patent attorney, died on Sept. 17 following a heart attack in his town residence at the Holley Hotel, N. Y. C. Mr. Woodward, who was in his 63d year, had been in failing health for some time.



First Place in "Lasting" Performance



The demands placed on a projector are much the same as those expected of the track man who goes out for the gruelling mile. Form, and smooth performance are necessary, of course, but it's the stamina, the ability to keep going when others drop out, that really counts.

The first model Motiograph, the Optigraph projector, was produced in 1896, the year motion pictures were first shown in a regular theatre.

Subsequent models were first with new developments, the acme in precision equipment, the finest examples in craftsmanship, always embodied exclusive developments. But above all they were made to last. The number of old Motiographs still in service around the country is unbelievable. Their owners won't part with them, so faithfully and so satisfactorily are they doing their job.

Your Motiograph dealer will be glad to tell you all about this superb equipment, or you may obtain literature describing the famous Motiograph projector and circular L72 on Motiograph-Mirrophonic Sound Systems by writing. . . .

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By *GEORGE S. APPLEGATE*

CHIEF ENGINEER, WESTERN ELECTRIC EXPORT CORP.

ALTHOUGH the intervention of war halted the development and supply of improved sound systems to the motion picture industry, it did not interrupt the continuous advance of scientific knowledge, the source of all technical improvements. On the contrary, the quest for new ideas assumed new urgency. Especially was this true in that branch of science of prime interest to the sound engineer—electronics. The contribution of sound engineers to victory has been great indeed, for they have been electronics specialists in an electronics war. And now, fortified with enough new knowledge for a whole generation—but knowledge acquired in only four brief years—their attention again turns to the arts of peace.

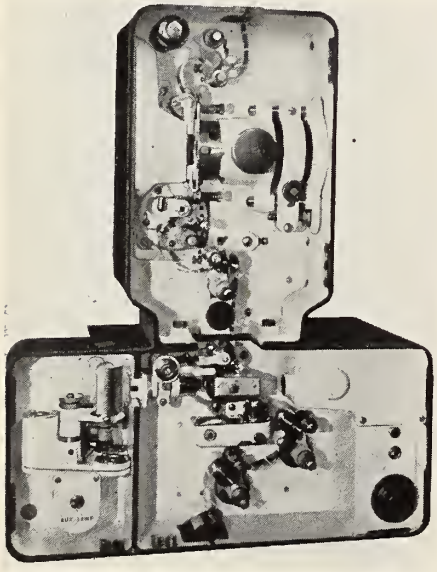
The Westrex Master System

One of the first post-war products to appear is the new sound-projector system announced by the Western Electric Export Corporation. As would be anticipated, the new equipment differs from pre-war models in many respects. This equipment comes in two models—the Westrex Master System and the Westrex Standard System.

The postwar performance of the new system results from a series of specific improvements in film propulsion, scanning, amplification and loudspeaker design. All operating controls have become a part of the unit-design and are assembled conveniently on the projectionist's side of the mechanism including the fader and changeover. This eliminates all controls and stray wiring from the front wall of the projection booth.

The drive motor is mounted vertically on the non-operating side of the machine. It is easily removable and easy to align. All major parts are enclosed by a simple rounded housing with hinged covers which afford easy access to any component requiring maintenance.

Among the controls centered conveniently on the projectionist's side is a special brake on which fingertip pressure brings the motor and projector mechanism to a quick, smooth stop in event of film breaks or other emergencies. Twin exciter lamps of the pre-focus type mount side by side. A simple flip of the finger substitutes one for the other in event of burn-out. Both lamps are shock mounted and adjustable vertically and laterally to assure perfect alignment with the lens tube.

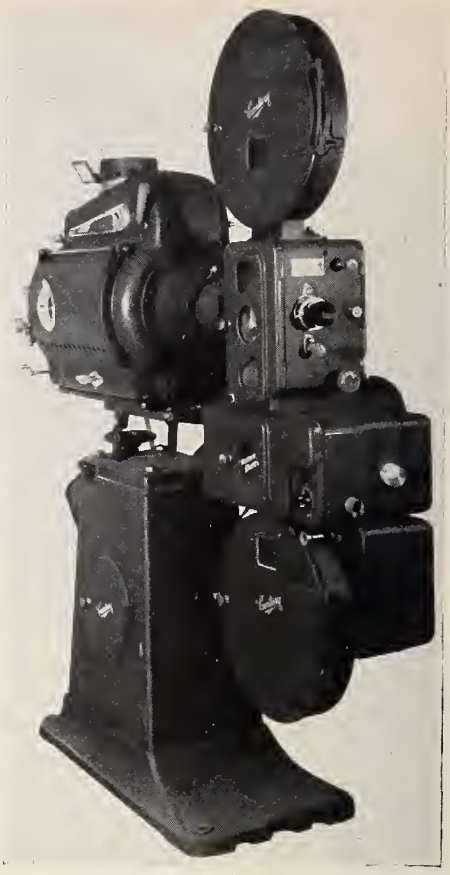


The new Westrex Master Sound reproducer is here shown (from the projectionists' side) assembled with the Century mechanism. The Hydro Flutter Suppressor is mounted midway between the scanning drum and the sound sprocket.

Flutter Problem Solved

War experience provided the engineers with what appears to be the final solution to the pre-war problem of "flutter." In the past, great sums have been expended on the development and exploitation of various anti-flutter gadgets without much success. Of these, perhaps the oil-damped flywheel enjoyed the most widespread use. In this device the film passed over a rotating drum, the motion of which was controlled by a free, heavy flywheel housed within a light, hollow flywheel—oil filling the space between them. Variations in film speed were countered by the viscosity of the oil. Its operation was, of course, subject to many vagaries arising from variations in temperature, disturbances in the motion of the film of such violence as to exceed its stabilizing effect, aging, etc.

The solution of the flutter problem, as provided by the Westrex equipment, is based on a totally different principle. It involves three steps: (1) isolating the sound mechanism by means of two free loops of film; (2) imposing a uniform load on the scanning drum, and (3) imparting a uniform drive to the film as it propels the scanning drum.



The new Westrex Master Sound reproducer is here shown assembled with the Century mechanism and base. The equipment may be used with any standard mechanism.

By delivering film to the soundhead through a free loop, disturbances which originate in the projector are blocked before they can reach the point at which the sound track is scanned. Disturbances in the take-up mechanism are similarly nullified.

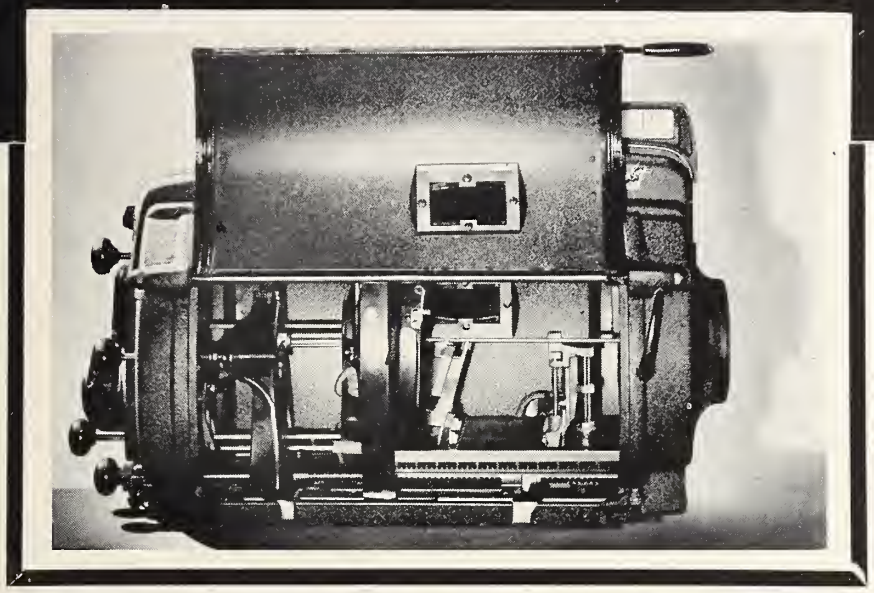
Operation of Scanning Drum

Now, with this condition provided, if the scanning drum and its associated flywheel can be made to operate under a precisely uniform load while subject to an equally uniform driving force, the rotary motion of the scanning drum must, of necessity, be uniform also. The design of the Westrex System meets the two latter conditions.

First, the scanning drum and its flywheel turn on *outboard* ball bearings. The flywheel carries a heavy ring of copper. The inner face of the flywheel housing supports four permanent magnets so spaced that their fields cut the ring at equal intervals around its circumference. Induced eddy currents provide a load of the required constancy. This load may be increased or decreased by adjustment screws which move the magnets.

Provision for the sound requirement, a constant driving force, has been met with equal ingenuity. In pre-war designs,

THE THING THAT COUNTS
is the picture on the screen



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the film passed as a gentle curve from the scanning drum to the sound sprocket. A slight increase in the speed of the sprocket caused the curve to straighten and, hence, to impart a sudden pulse or jerk to the scanning drum. When the sprocket slowed, a surplus of film flowed into the deepening curve and the driving force on the drum diminished. In either case, the film loop tended to act as an undamped spring, and oscillations, or flutter "wows," persisted for an appreciable interval following the irregularity.

Now, with a means for applying a *compensating pressure* at some point along the loop of film between the sound sprocket and the scanning drum, to take up the slack continuously, the film will move under *constant tension* and the driving force it exerts on the drum will also be uniform.

"Hydro Flutter Suppressor"

In the Westrex System, this is accomplished with a mechanical filter which the Westrex engineers have called a "Hydro Flutter Suppressor." In it, a lever arm pivoted at one end by two miniature ball bearings, carries, at the free end, a pair of small ball races which, as a pad roller, rides against the film. A small adjustable spring causes the pad roller to exert a constant pressure. The lever arm also carries a miniature piston which moves in a cup of special damping fluid. This smooths the action further. Thus, in the Westrex System, all three initial conditions for flutter-free operations have been met.

Laboratory measurements show a flutter factor of only .07%, or just about half of the .15% minimum standard prescribed for the industry by the Academy of Motion Picture Arts and Sciences.

Another feature of special interest in the Westrex Master System is the method of adjusting the film alignment at the scanning point. This is accomplished by a calibrated micrometer. After noting the mark on the indexed dial of the micrometer which corresponds with the proper setting for a normal point, the projectionist may vary the adjustment over a wide limit to compensate for sound tracks which have been printed off center. A simple twist of the dial restores the adjustment to normal. It is difficult to over-emphasize the convenience of this feature.



Close up view of the Hydro Flutter Suppressor. Essentially the device consists of a pivoted, fluid-damped lever arm which makes contact with the film loop between the sound sprocket and scanning drum through a ball bearing pad roller. It takes up any slack in the loop, however slight, and conversely responds when the loop tightens. This action results in the application of a precisely constant driving force to the scanning drum and, hence, flutter free operation.

For years the question has been debated—which is better, variable density or variable area recording? Westrex engineers concluded that best results can be achieved only when the projection characteristics of each are taken properly into account by the design of the theatre equipment.

A novel optical element, which in essence is a diffusing lens, is inserted between the objective end of the lens tube and the window of the photo cell. Light from either type of sound track passes through the diffusing element and falls on the sensitive surface of the photo cell as a glowing disc of constant *area* but variable *intensity*. In the final reproduction, this results in sound which exhibits the best features of both tracks but it is especially marked when projecting variable area prints.

In any sound system the photo cell output represents a ticklish quantity. The slightest defect in either wiring, insulation or shielding may easily induce a crash of noise capable of wrecking all but the most carefully designed loudspeakers, not to mention its effect on the audience. One good solution, of course, is to amplify this low level energy quickly, ahead of the fader. In pre-war systems, this meant hanging a bulky pec-amplifier onto the mechanism with all its attendant evils of mechanical unbalance, cramped space and difficult maintenance.

An exceptionally good answer to this dilemma appeared in the war-born "walkie-talkie." Miniature vacuum tubes and other circuit elements developed primarily for military applications have made possible a Westrex Master pec-amplifier which fits easily into the palm of the hand. The unit sits right beside the photo cell itself.

Main Amplifier Design

The Westrex main amplifier represents the culmination of Western Electric design experience which began 30 years ago with the installation of the world's first commercial amplifier for transcontinental telephone communication in 1915. Depending upon the tubes used, this amplifier delivers 40 to 50 watts, eight times the power formerly used to fill the largest theatre in North America and more than ample to reproduce even the loudest sound effect in most theatres. For highest efficiency, it operates on the negative feedback principle, a development of Western Electric and Bell Telephone Laboratories. Harmonic distortion, an index of amplifier quality, is less than 2 percent.



Close up of the Westrex Master reproducer. Note simplicity of threading as film passes under the pad roller of scanning drum, over Hydro Flutter Suppressor and finally is discharged from the machine by the sound sprocket. The pec-amplifier may be noted in the upper right. Both the photo cell and two stages of pre-amplification are carried on a miniature, shock mounted chassis.

The amplifier design, including the photo cell and pre-amplifier, calls for standard type vacuum tubes.

All power conversion from standard a.c. is made electronically by a rectifier of conservative design which delivers energy for the photo cell, filaments and plate circuits. A red bullseye, in the cover of the rectifier, lights when the unit is in operation.

Loudspeaker Improvements

The Westrex Master takes full advantage of the latest developments in loudspeakers. All voice coils operate in a field maintained by permanent magnets. Individual units, with special characteristics, project low and high frequency sound. Cross modulation between the two, as in the final stage of amplification, has been reduced to an absolute minimum.

In addition, the conversion efficiency, that is to say the translation from electrical energy to acoustic energy, has been *doubled*. This was achieved both by wartime advances in design and by utilizing the energy formerly lost behind the screen. Hence, with an amplifier output of 50 watts the Westrex Master delivers the *same volume of sound* as previous systems equipped with 100 watt amplifiers.

Specially designed baffles not only utilize the energy which formerly escaped from the rear of the speaker but greatly accentuate the factor known as "screen presence" and distribute the sound uniformly throughout the auditorium. Because of these characteristics, the need for backstage draping no longer exists. The required number of speakers varies with the individual theatres but in

(*Continued on page* 30)

CHAINS, BELTS *or* GEARS?†

SOUND reproducers and projector mechanisms, and sound reproducers and take-ups of various makes and models, are coupled together by either chains, belts or gears, while some projector mechanisms even use a combination of sprockets and chains instead of interlocking gears.

Each of the three methods of coupling has its champions among theatre equipment manufacturers, projectionists and service engineers, so that an examination of our experience in utilizing all methods may aid in determining which, if any, method is superior to the others.

Types of Chains

Chains fall roughly into two classifications—the so-called "silent chain" and the "roller chain" (the latter usually termed a bicycle chain). Motiograph has utilized both types of chains in several different applications, and our experience indicates that the "silent chain" is superior to the "bicycle chain" type for use in projection room equipment.

"Silent chains," such as those which motiograph and Dominion Sound Equipments, Ltd., utilize to couple their 7500 sound reproducer with projector mechanisms, have very obvious advantages over roller chains. Chief among them are longer life, more silent performance, no tendency to slip, greater flexibility to cushion shocks and but slight tendency to stretch.

The long wearing quality of "silent chains" is well indicated by the fact that in several thousand installations of Motiograph 7500 sound reproducers made in the last six years, there have been no sprocket or chain replacements as a result of breakage or wear.

The so-called "bicycle chains" have proven satisfactory as a method of coupling sound reproducer and take-up, as the load is relatively light. As a substitute for a gear train in a projector, however, the "bicycle chain" has proven unsatisfactory because of its tendency to stretch, which, of course, has the same effect on machine performance as a gear train with considerable back-lash.

The use of "silent chains" in projector mechanisms themselves has not had sufficient trial to determine their value as a substitute for a gear train, but as none of the projector manufacturers who have a large number of theatre installations use such chains within projector mechanisms, it would seem that any such use is not likely to become general.

There is unquestionably a trend in all industry to couple machinery to its power source by means of "silent chains" instead of gears or round or flat belts, and perhaps other manufacturers will follow Motiograph's lead in coupling sound reproducers and projector mechanisms by this means.

Many projectionists have had trouble with belt slippage and breakage in operation, and consequently there has been built up an antipathy against belts of all kinds. Invariably, however, this dislike can be traced to the old sewing-machine type of round leather belt indifferently clipped together. (They will perform reasonably well, however, if kept very tight over their associated pulleys.)

Round leather belts have not proven overly satisfactory because they are often too long at original or replacement installation, and they have a tendency to stretch, which causes frequent slippage. Projection equipment is usually overoiled, and oil and leather just don't get along, which, of course, means frequent replacement of such belts.

Advantages of V-Belt

The V-belt type has been most satisfactory in all applications in projection equipment, but even the V-belt has found some enemies. Reported difficulties with the use of V-belts, however, usually can be traced to the use of V-belts with pulleys designed for operation with round belts. When V-belts are utilized with pulleys actually designed for use with V-belts, it has been found that they will work exceptionally well in power transmission or in driving take-ups. V-belts well fitted to associated pulleys are even more silent in operation than so-called "silent chains" and are much less costly than both silent and bicycle type chains.

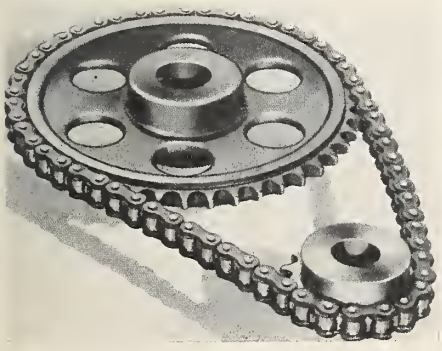
The more common type of V-belts in use today are made something like a tough casing of an automobile tire. Heavy low-stretch cords impregnated with rubber compound form their center, with a two-ply rubberized fabric cover on all sides. V-belts grip their associated pulleys by side pressure, which brings about firm gripping with virtually no slippage. Belts of this type not only give superior performance, but far outwear the round leather type. Though there is no marked tendency to slip, there is sufficient flexibility to V-belts to absorb the starting shock of the motors.

The war has brought a new development into the construction of V-belts, which should add materially to their life, and forever remove any tendency to stretch. This new development is the utilization of fine steel wires, surrounded by a rubber compound as a center for the V-belt, the center then being covered with a two or more ply rubberized fabric. Some of the synthetic rubbers which will undoubtedly be utilized are also unbelievably resistant to the effects of oil.

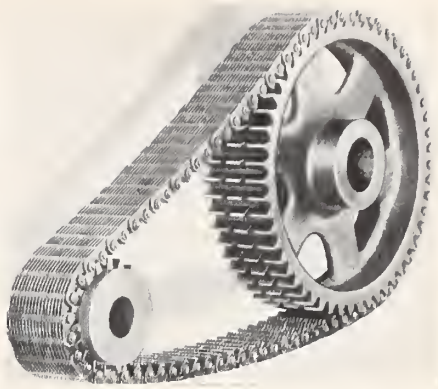
In the light of our experience, it seems most probable that these new silent, long wearing V-belts will, in the post-war period, be utilized in place of some sound reproducer gears and certainly will be used to couple sound reproducers and take-ups.

It is hoped that this brief exposition will bring about a better understanding of the use of silent and roller chains and round and V-belts in present and post-war projection equipment.

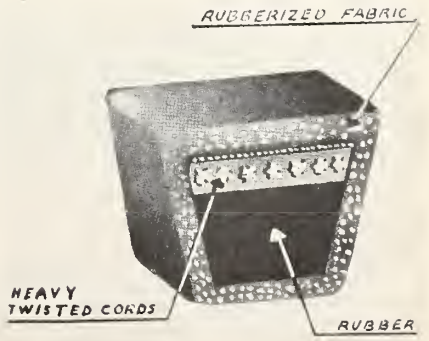
† *"Sound Track," Vol. IV, No. 6, published by Motiograph.*



A roller or "bicycle chain" drive.



A silent chain drive.



Cross section of V-belt.

IN THE SPOTLIGHT



By *HARRY SHERMAN*

WHILE attending the combined three-day conference of the Theatre Equipment Dealers Protective Association and the Theatre Equipment Supply Manufacturers Association, held recently at the Edgewater Beach Hotel in Chicago, we were struck with the interest shown in the various exhibitions by visiting projectionists from all parts of the country. It speaks well for the craft and for the industry that many members of the I.A. from as far west as the state of Washington and as far south as Florida attended the convention, many of them at their own expense.

Several projectionists exhibited their own inventions, one of them, Ellsworth S. Miller, member of Detroit Local No. 199, displayed a hub to be placed on the take-up reel which we think is a pip. Then there was I. Merkur, member of New York Local No. 306, who showed one of the two splicers on exhibition, in addition to a reel-end alarm that aroused a great deal of favorable comment from many of the dealers present.

Among the I. A. visitors we spotted were International representative Orin Jacobson, Tacoma, Wash.; Harry Joslin, president Miami Local No. 316; Harry Blumberg, Local No. 307, Philadelphia; Houston Morton and J. W. Padfield, Detroit Local No. 199; Gene Atkinson, business manager, and Clarence Jalas, assistant business manager of Chicago Local 110, and Larry Strong (Strong Zipper Changeover), member of Local 110. Milwaukee Local No. 164 was represented by Elmer Klase, president, Otto Trampe, business manager, John Black, Louis Behrend, and several other members whose names we do not recall at the moment.

● E. L. Rhodes, member of Local No. 320, Savannah, Ga., and with the United States Army Motion picture Service for the past three years, is now connected with the Altec Service Corp., working from the Jacksonville, Fla. office.

● Harry Abbott, for many years vice-president of Local No. 307, Philadelphia, was recently elected president of the local, succeeding Louis Krouse, former I. A. General Secretary-Treasurer and president of the Philadelphia local for the past 34 years, who retired from both offices several months ago because of ill health.

Abbott Oliver, another old line member of Local 307, was elected to fill Harry Abbott's former post as vice-president. Both men are practical projectionists and have been employed at the Mastbaum Theatre in Philadelphia for many years.

● I. A. representative Orin M. Jacobson, member of Local No. 175, Tacoma, Wash., and secretary for District No. 1, was voted the best looking member of the I. A. official family. Although Jacobson has been heard to brag about his terpsichorean feats, modestly comparing himself very favorably with professional dancers, we think he will have to step aside on that score and pass the laurel wreath to International Projector's P. A. McGuire. Mac need not worry about Jake's claim in that direction for it is conceded by all that P. A. can outdance and outlast any man on the dance floor.

● Chicago Local No. 110 boasts of the exploits of one of its charter members, Carl N. Danielson, who saw action in our last three wars. He fought in the Spanish-American war, serving with Admiral Dewey in Manila, and in 1914 he enlisted in the United States Navy, serving four years as a lieutenant in the Transport Division, subsequently being promoted to the rank of lieutenant commander.

Early in 1943 at the age of 68, Danielson entered the Merchant Marine with the rank of lieutenant. Several months later he made his first contact with the enemy when his convoy, which consisted of 27 ships, was attacked by 47 German planes soon after passing Gibraltar. In the ensuing action 17 German planes were shot down, three of which were accounted for by Danielson's ship. After unsuccesful attempts by German submarines to destroy the ships, the convoy reached Oran safely, only to be attacked once again by German aircraft. Eventually the convoy reached its destination and Danielson received the stripes of a lieutenant commander for his participation in this action.

He also took an active part in the preparation for the Italian invasion. On September 2, 1943 a completely blacked



In recognition of his untiring efforts to raise and maintain the high standards of projection, P. A. McGuire, Director of Public Relations for International Projector Corp., was presented last month with a gold honorary membership card by the officers of I. A. Local No. 306, New York City.

Present at the ceremonies and pictured above are, left to right: Morris Klapholz, Harry Storin, vice-president; Herman Gelber, president; James Ambrosio, treasurer; Morris J. Rotker, Ben Scher, Brooklyn business representative; Henry Weinberger, P. A. McGuire, Mike Berkowitz, Lester B. Isaac and M. D. O'Brien, Loew's, Inc.; Morris Kravitz, New York business representative; Nathaniel Doragoff, recording secretary, and Frank E. Miller, sergeant-at-arms.

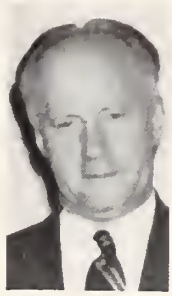
out convoy steamed out of Oran harbor loaded with troops and war supplies. Two days later the ships entered Salerno Bay after their attempted landing at Naples had been repulsed. The Americans, under Gen. Mark Clark, had already established the beachhead over heavy opposition. The convoy made ready to disembark and at 3 a.m. the first landing barges that hit the beach were met with intense artillery fire. After bitter fighting and the arrival of reinforcements the Americans gained control of the beach.

Ten days later the ship on which Danielson was stationed was struck by a 5,000 lb. bomb which passed through the four decks and exploded underneath. Although he was severely wounded, he was the last to leave his ship. He dived overboard and was struck unconscious when a damaged lifeboat fell on him. He was picked up and taken aboard a hospital ship, and after hovering between life and death for many weeks he finally recovered sufficiently to be returned to this country and is now resting at his home in Park Ridge, Ill.

The conduct and sacrifice of this "three war man" rates a salute from every man in the Alliance and we take our hat off to a man who would not permit his advancing years to block his attempts to help his country in her dark hour of peril.

● Present at the signing of surrender terms by the nips was one Mike Salamone, member of Local No. 182, Boston, Mass. Salamone was one of the guards on duty on the battleship Missouri where the signing took place, and had his finger on the trigger of his gun ready for any indication of double-cross.

GLENN H. HUMPHREY DIES



It is with deep regret that we report the death of Glenn H. Humphrey, business agent of Local No. 337, Utica, N. Y., and former secretary of the 10th District. Early this year steadily failing health forced Glenn to give up his position at the Stanley Theatre in Utica where he had worked as projectionist for the past ten years. He retired to his summer home at Redfield, Oswego County, several months ago, hoping to regain his health. His sudden death on October 8 came as a shock to his many friends in the Alliance and in labor circles throughout the state.

Glenn Humphrey was born in Utica on November 15, 1893. He took his first projectionist job at the Alhambra Theatre in Rochester, later working at most of the motion picture theatres in Utica, where he remained until his retirement. He was associated with the Utica Trades Assembly for over 30 years and was its president from 1937 to 1943. He also served as a delegate for that organization from 1915 to the time of his death.

He served as president of the New York State Association of Motion Picture Projectionists from 1927 to 1933. From 1932 through 1944 he was secretary-treasurer of the New York State Theatrical and Motion Picture Trades Conference.

Glenn had what it takes to make a sound level-headed union executive. He had a striking personality and an engaging manner—was friendly and dignified. He had very definite ideas on matters pertaining to the future welfare of the craft and his opinions were highly regarded by his associates. He had the esteem and affection of all who knew him and we feel a personal loss in his passing.

We extend our deepest sympathies to his survivors—his widow and only son, Jack Humphrey.

● Arthur Kimball, Local No. 42, Omaha, Nebraska, was recently elected president of the Nebraska Association of I. A. locals. Other officers elected are Alvin Kostlan, of Omaha Local No. 343, as vice-president; Roy Warner, of Lincoln Local No. 151, as second vice-president, and Clyde Cooley, secretary of Omaha Local No. 343, as treasurer.

I. A. representative Roy Brewer, George Hartnett, secretary of Des Moines Local No. 286 and secretary of the Iowa State Association; and Bob Marksbury, business agent of Sioux City Local No. 355, were among the visitors.

● Thomas J. Shea, business agent of Local No. 375, Middletown, Conn., and I. A. representative, has been appointed assistant president of the I. A. T. S. E. We wish Tom good luck in his new post and we know he will prove an asset to the official family.

● Westchester County Local No. 366 will hold a dinner and dance at the Taft Hotel, New York City, October 28, in commemoration of its 30th anniversary as a member of the I.A.T.S.E., and as a testimonial to Joe Monaco, business agent of the local for more years than we care to shake a stick at. Joe is one of the most popular guys around these parts and a record breaking turnout is expected at the party. We'll be seeing you on the 28th, Joe.

● Every once in a while we lay off writing about projection room fires, for it gets rather monotonous to read of this fire and that fire, and of this and that projectionist being burned. Monotonous, that is, to everybody but the victim.

City officials send their fire inspectors around to the theatres to make sure that the "no smoking" law is enforced, and that the stage curtains are fireproofed, but very few bother much

(*Continued on page* 27)



Some of the members and officers of Film Post No. 1292. Standing, front row, left to right: Charles Beerholm, Barney T. Wiener, Maurice Shay, Nathaniel Doragoff (post commander), Ben Norton, Louis Spiegel, Father McCormick, Tony Rugino, Harry Waks. Rear row, left to right: Nat Eisenstein, Ernest Giessman, George Scott, Archie Hollander, Barney Ellman. Seated, left to right: George Minookian, Elias Ashkenas, Aaron Sobel and Leo Sobel.

Projectionists' Course on Basic Radio and Television

By *M. BERINSKY, E.E.*
MEMBER OF INSTITUTE OF RADIO ENGINEERS

XVI—A. C. CIRCUITS and VECTORS

THE SOLUTION of alternating current circuits is essential to a basic knowledge of radio and television. In order to solve such circuits properly a knowledge of vectors is very desirable. It is the purpose of this article to show how vectors and trigonometry are applied to electrical circuits.

A.C. Series Circuit

When a resistor is connected in series with a coil and the combination is connected across a source of alternating current, the circuit of Figure 1 results. The coil offers a certain amount of a.c. resistance which is known as inductive reactance. If there were no other resistance in the circuit the current would be equal to the line voltage divided by the inductive reactance.

In most practical circuits, however, some resistance will exist. The resulting resistance to the flow of an alternating current in such a circuit is known as impedance and is given mathematically as the square root of the sum of the squares of resistance and reactance.

We learned in a previous article that the formula for this impedance is $Z = \sqrt{R^2 + X^2_L}$ where Z is the impedance in ohms, X_L is the inductive reactance in ohms, and R is the resistance in ohms. We will recall that X_L equals 2π (p) f l. The current that flows in such a circuit is given by the formula for a.c., Ohm's Law which reads $I = \frac{E}{Z}$. The voltage drop across the coil is $E_L = I X_L$, and the voltage across the resistor is $E_R = I R$.

The phase relations between the voltages and the line current is shown in Figure 2. This diagram shows that the line current lags the voltage across the coil by 90°, and the voltage across the resistor is in phase with the line current. The method for showing phase relations becomes very complicated when several voltages and currents are to be shown on a diagram of the type used in Figure 2.

In practice a much simpler method is used. This is called a vector diagram. A vector is a quantity that has magnitude and direction. The voltage drops in an alternating current circuit fall into this category. The vector diagram consists of two lines which intersect at right angles, as is shown in Figure 3. The voltages in an a.c. circuit are assumed to consist of lines which rotate at certain angles to each other. The point from which the vectors rotate is labeled *a* in Figure 3. This is known as the starting or reference point. The direction of rotation is assumed to be counter-clockwise, as shown by the curved arrow in this figure.

The quantity that is common to all parts of the circuit is usually laid off along the reference line. Thus, in a series circuit the current would be laid off along this line, because the current is common to all parts of a series circuit. Figure 4a illustrates this point. The voltage drop across the resistor is in phase with the current. This means that the angle between this voltage and the line current is zero and the two quantities will be together on the reference line. Figure 4b shows this condition.

The current in the circuit of Figure 1 lags behind the voltage across the coil by 90°. Since the direction of rotation is counter-clockwise, the voltage across the coil should be shown as moving 90° ahead of the current in a counter-clockwise direction. This is shown in Figure 4c.

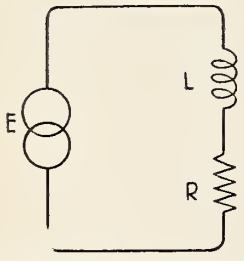
In order to find the angle between line voltage and line current it is necessary to complete the parallelogram of Figure 4c. This is done by drawing a straight horizontal line from the top of E_L parallel to E_R, and a straight vertical line from the end of E_R parallel to E_L, as may be seen by referring to Figure 4d. The line voltage E is the vector sum of the voltage across the coil and the voltage across the resistor.

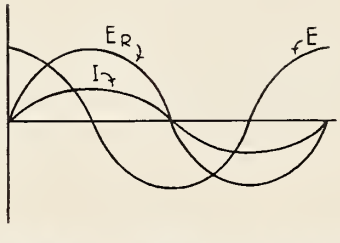
The right-hand side of the parallelogram often is used as shown in Figure 4e. The phase relations between the line voltage and the line current can be obtained graphically by means of a protractor if E_L and E_R are drawn to the same scale. From a previous installment of this series we learned that $E_L = I X_L$ and $E_R = I R$. E is equal to I Z.

Figure 5a shows the same diagram as Figure 4e except that the voltages have been replaced by their equivalents. Since I is common to all parts of the circuit it may be removed and the diagram of Figure 5b will result. From this diagram it can be seen that $Z = \sqrt{R^2 + X^2}$.

Finding Phase Relations

The phase relation between line voltage and line current, while it can be found with reasonable accuracy by graphical means, is more often found by the simpler and more accurate mathematical method. The use of trigonometry is required. In an earlier article the trigonometric functions most commonly used were given. When E, E_L, and E_R are known, any of the trigonometric formulas that were given at that time could be used as an easy means for finding the phase angle between line voltage and line current. When only two of the three vol-





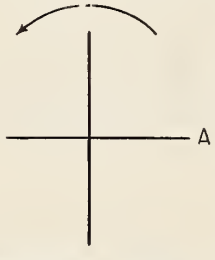


FIGURE 1. *(Left) Inductance and resistance in series.* **FIGURE 2.** *(Center) Method for showing phase relations by means of sine waves.* **FIGURE 3.** *(Right) Vector diagram—A is starting point.*

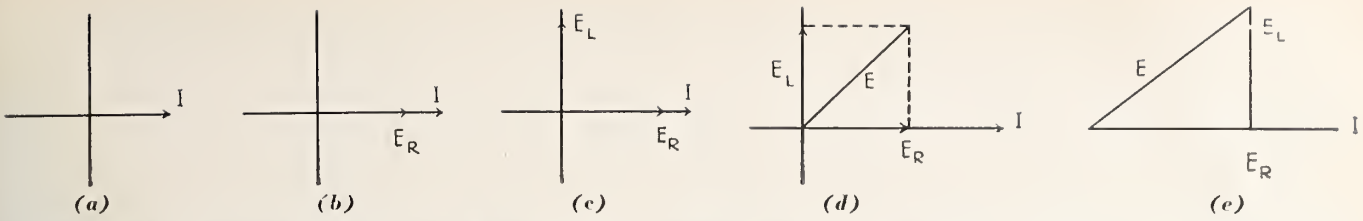


FIGURE 4. *(a) I represents the reference vector; (b) E_R is in phase with I; (c) E_L and E_R are 90° out of phase; (d) and (e) method for completing parallelogram.*

tages are known the trigonometric function that contains these known values must be used. This applies also to the diagram of Figure 5b.

The sine of the angle between voltage and current is equal to E_L/E or X_L/Z. The cosine of the same angle equals E_R/E, or R/Z; and the tangent of this angle equals E_L/E_R or X_L/R.

As an example, supose that the diagram of Figure 5b has the following values: Z = 10 ohms. X_L = 8 ohms, and R = 6 ohms. The angle between line voltage and line current could then be found by using the trigonometric formulas given above.

Using the sine formula, the sine of the angle would be 8/10 or 0.8. Reference is now made to a table of trigonometric functions and it is found that the angle whose sine equals 0.8 is an angle of 53.1°.

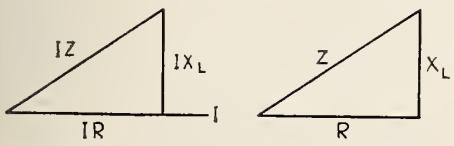
The cosine formula can be used in a similar fashion. The cosine of the angle of Figure 5b equals 6/10 or 0.6. From the table of trigonometric functions it is found that the angle whose cosine is 0.6 is 53.1°.

The tangent can be used for the same purpose. The tangent of Figure 5b equals 8/6 or 1.3333 and the angle corresponding to this tangent is also 53.1°.

It will be seen that the use of any one of the formulas given will yield the same results. In Figure 4e we note that the line voltage leads the line current because it is in front of the line current in the direction of rotation. The angle by which the line voltage leads the current is 53.1°.

Capacitance and Resistance In Series

The vector diagram for capacitance and resistance is very similar to that for inductance and resistance. There is one difference, however, and that difference results because of the phase relations, these relations being exactly opposite from those involving inductance. When



FIGURES 5a (left) and 5b (right). Impedance triangles.

SEPTEMBER QUESTIONS AND CORRECT ANSWERS

1. **(Q.) What is the total capacitance of a 12 mfd. condenser connected in parallel with a 6 mfd. condenser?**
   (A.) 18 mfd.
2. **(Q.) What is the total capacitance of the same condensers connected in series?**
   (A.) 4 mfd.
3. **(Q.) What is the capacitive reactance of a .01 condenser at 10 kilocycles?**
   (A.) 1592 ohms.

resistance and capacitance are connected in series the diagram of Figure 6 is used, and this diagram shows that the voltage across the condenser lags the line current by 90°.

The impedance diagram is shown in Figure 7. The difference in the direction of X_C and the X_L of Figure 5b is due to the fact that a condenser produces phase relations which are exactly opposite to those produced by a coil. The calculation of impedance in a circuit involving a condenser and the method for finding the phase angle in such a circuit is exactly the same as given in the preceding paragraph for an inductive circuit.

Resistance, Inductance, and Capacitance in Series

In most radio circuits, inductance, resistance, and capacitance appear in combination. In many instances they are connected in series. Such a circuit is shown in Figure 8, together with the vector diagram pertaining to this circuit. As this is a series circuit, the current is the same in all parts of the circuit, and for convenience, the current vector I is laid off horizontal in the circuit vector diagram. The voltage (E_R) across the resistance is in phase with the current and is laid off to scale along the current vector. The voltage (E_L) across the inductance is laid off at right angles to the current and leading. The voltage (E_C) across the capacitance is laid off at right angles to the current and lagging.

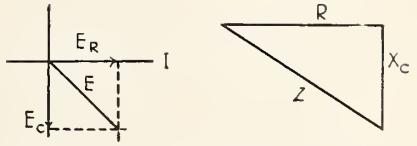
A study of Figure 8 shows that the voltage across the inductance and that across the capacitance are in opposition, so that the resultant voltage of these two is their arithmetical difference. In this particular case E_L is shown as being greater than E_C. E_C, therefore, is subtracted directly from E_L. The line voltage must be the vector sum of the three voltages and the hypotenuse of a right triangle of which E_R and $(E_L - E_C)$ are the other sides. If we substitute R, X_L, and X_C in place of E_R, E_L, and E_C as was done in the previous example, and if we substitute Z for E, then the two sides of the triangle becomes R and $(X_L - X_C)$, and the impedance Z which is the vector sum of the two sides of the right triangle is given by the formula $Z = \sqrt{R^2 + (X_L - X_C)^2}$.

In order to solve such a formula the following steps should be taken. First find X_L and X_C; subtract X_C from X_L and square the difference: square R and add the result to $(X_L - X_C)^2$; then take the square root of the quantities that were added. Z, the impedance, is in ohms. The phase angle can be found as in previous examples. The tangent can be conveniently used; the tangent of the phase angle equals $(X_L - X_C)/R$. If X_L is greater than X_C, the tangent is positive and the angle is positive as is shown in Figure 8. This indicates a lagging current. If X_C is greater than X_L the tangent becomes negative and the phase angle becomes negative. This indicates a leading current, and is illustrated in Figures 6 and 7.

Mathematical Solution

The mathematical solution of a circuit that contains resistance, inductance, and capacitance is not difficult if a series of systematic operations are made. As an example, let us suppose that a series circuit consisting of a resistance of 50 ohms, a capacitance of 25 mfd., and an inductance of 0.15 henry is connected across 120 volt, 60 cycle mains.

The problem is to find (a) the impedance of the circuit; (b) the current in the circuit; (c) the voltage across the



FIGURES *6 (left) and 7 (right). Resistance and capacitance in series.*

Presenting: Stanley T. Perry



STANLEY T. PERRY, president, for the past three years, of the Kinema Projectionists and Engineers Association in London, has been an active worker in the interests of labor since 1912, when he became interested in the projectionist craft.

Perry is projection supervisor at the Empire Theatre in Leicester Square, a 3,300 seat house equipped with every motion picture refinement, together with a forty-piece orchestra, an organ and stage presentations. His appointment to his present post goes back to 1928 when the Empire was opened as the fourth theatre in England to make its debut with sound equipment.

His first position was at the Park Cinema, a suburban house located in Ravenscourt Park, London. It was there that he screened the first Metro film to be released in England, "The Shooting of Dan McGrew," featuring Mitchell Lewis, who still is acting in M-G-M pictures.

"Stan", as he is known in the profession, took over his first chief's job in 1914 at the Electric Theatre, Chiswich, London, a house that played to capacity at matinees for the reason that the manager of the theatre was the originator of the "free cup of tea and biscuits" to all afternoon patrons. (Happy days).

He served four years with the British Army in World War I, three of these being spent in France. After the armistice he joined the Expeditionary Force Cinemas and showed pictures to the troops until he was discharged. After a spell at the Scala Cinema, Hammersmith, London, Perry sought a change and worked for the Stoll Studios in London as an electrician. He worked on many outstanding British films of that period, notably the first Prizmacolor feature picture, "The Glorious Adventure," with Lady Diana Manners and Victor McLaglen, produced by J. Stuart Blackton, oldtime Vitagraph director.

In the spring of 1922 Perry left for London's West End and at the old Philharmonic Hall there he showed a long series of Fox Film presentations. Later that year he worked at the Palace Theatre showing the "Four Horsemen of the Apocalypse." Rear projection, with special lenses, was used for this presentation, and it took fifteen men to operate the mechanical effects on the stage. The picture, which ran for almost six months, still remains a landmark in English screen presentation.

A year later the Tivoli Theatre was opened in London's famous Strand, showing Metro productions exclusively and Stan Perry remained there until 1928 when Metro sold the theatre and opened the Empire at Leicester Square.

In addition to his theatre work he found the time to take on the duties of president of the Guild of British Kinema Projectionists and Technicians, an office he held for thirteen years until it was absorbed by the Kinema Projectionists and Engineers Association. His hobby is to keep abreast of the times in knowledge of the progressing art of projection, and his ambition is to see all branches of the industry in England joined in one great union on the order of our own I. A. T. S. E., a project which keeps him pretty busy.

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resistance; (d) the voltage across the inductance; (e) the voltage across the capacitance; (f) the power taken by the circuit; (g) the phase angle of the circuit, and (h) the power factor of the circuit.

Solution. In order to find the impedance (a) it is necesary to find first the inductive and the capacitive reactances. $X_L = 2\pi f l = 2 \times 3.14 \times 60 \times 0.15 = 56.6$ ohms.

$$X_C = \frac{1}{2\pi f c} = \frac{1}{2 \times 3.14 \times 60 \times 0.000025} = 106 \text{ ohms.}$$

$$Z = \sqrt{R^2 + (X - X_C)^2} = \sqrt{(50)^2 + (56.6 - 106)^2} = \sqrt{(50)^2 + (49.4)^2} = 70.2 \text{ ohms } (\textit{answer}).$$

(b) The current: $I = E/Z = 120/70.2 = 1.71$ amps. (*answer*).

(c) The voltage across the resistance: $E = I R = 1.71 \times 50 = 85.5$ volts (*answer*).

(d) The voltage across the inductance: $E_L = I X_L = 1.71 \times 56.6 = 96.8$ volts (*answer*).

(e) The voltage across the condenser $E_C = I X_C = 1.71 \times 106 = 181.1$ volts (*answer*).

(f) The power in the circuit is equal to $I^2 R$, because a pure reactance such as a perfect coil or condenser does not consume power, the only part using power, therefore, will be the resistor $P = (1.71)^2 \times 50 = 146$ watts (*answer*). The same result would be obtained if the voltage across the resistor were multiplied by the current through the resistor.

(g) The phase angle between the line voltage and the line current can be obtained by first finding the tangent of the angle and then looking up the angle in a table: $\text{Tan} = \frac{X_L - X_C}{R} = \frac{56.6 - 106}{50} = \frac{-49.4}{50} = -0.988$. The angle corresponding to this figure is an angle of $-44.6°$. The angle is negative indicating that the current in this circuit leads the voltage. This was also indicated by the fact that the voltage across the condenser was greater than the voltage across the coil, or by the fact that the capacitive reactance was greater than the inductive reactance.

(h) The power factor of the circuit is equal to the cosine of the angle between voltage and current. This is equal to R/Z and equals 50/70.2 or 0.712 (*answer*). The power factor usually is expressed as a percentage so the answer would be 71.2%. The total power of the circuit as found in section (f) could also have been found by using the formula $P = E I \times$ power factor.

It can be seen that the voltage across the condenser exceeds the line voltage by a considerable amount. This would be impossible in a d.c. circuit, for the voltage across any part of a d.c. circuit can not exceed the line voltage. This condition can exist in an alternating current circuit, because the capacitance voltage and the inductive voltage are in direct opposition, being 180° out of phase. Both of these voltages may be large, provided their difference is less than the line voltage.

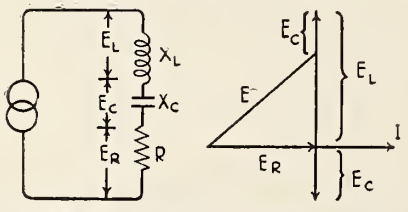


FIGURE 8. ***Resistance, inductance, and capacitance in series.***

OCTOBER QUESTION

1. A series circuit consisting of 10 ohms resistance, 30 ohms inductive reactance, and 20 ohms capacitive reactance is connected across 220 volt, 60 cycle mains. Solve the problem for (1) the impedance, (2) current, (3) voltage across each part of the circuit, (4) power taken by the circuit, and (5) power factor and power-factor angle of the circuit.

The answer to this question will appear in the next issue.

AT YOUR SERVICE

This department is a collection of random thoughts and some not so random: fact, fancy and opinion relating to the man behind the man behind the gun—the serviceman. The prime purpose of this section is to promote a closer relationship between serviceman and projectionist based on a better understanding of their mutual problems through an exchange of news and views, kinks and kicks. To this end, contributions relative to any phase of the serviceman's activities are invited.

Rechargeable Flashlight Battery

Herewith, my testimonial after several months of use. While the light is not of the same quality obtained with a fresh set of ordinary batteries, it still is good.

It is not necessary to purchase a charger. Install a bracket in your car to hold it, run a hot wire to a convenient storage battery supply and connect a 6.3 volt, 0.15 ampere dial light in series. The lamp limits the charging current to 120 mils and the charging rate increases only slightly when the car generator is in the circuit.—S. J. Warkoczewski, *ALTEC.*

Eliminating 20 KC Interference

A curious case of sound trouble in the nature of high output reading without any audible signal was encountered with a sound system. The meter reading would advance as the volume control was advanced, yet no sound was heard other than the normally slight hiss. Trouble was found to be the introduction of a 20 KC note from the exciter supply into the PEC leads of one soundhead while the supply was switched to the opposite machine. It was found that if the supply leads are in close proximity to the photocell leads. this condition will result. Simply bending leads away corrected the effect.—F. M. Walls, *RCA.*

Determining Condition of Amplifier

I can tell the condition of an amplifier at a glance. The current drain is measured every month and recorded. Voltage readings are taken at least every three months. Any variation from normal calls for a complete check of the amplifier. While this is a small item, considerable time can be saved doing routine work.—M. Levy, *RCA.*

16-mm Gremlins

1. When honing the working surfaces on AMPROS, hold the tolerances to .001 or less. I get excellent results where picture steadiness is concerned by using a Lufkin 109-T thickness gage with the .0015 leaf honed down to .001 as a measure.

2. The practice of tapping or bending the shuttles before honing leads to some undesirable results. You may find, after tapping and honing, that the shuttle pull-down action is sticky at points. The remedy for this is to hone the side surfaces of the shuttle to a true plane. Keep clearances less than .001.

3. Sound wows due to scanning—wash sound bearings in carbon tet., spin ball bearings and listen. If you hear a clicking noise, replace the bearings.

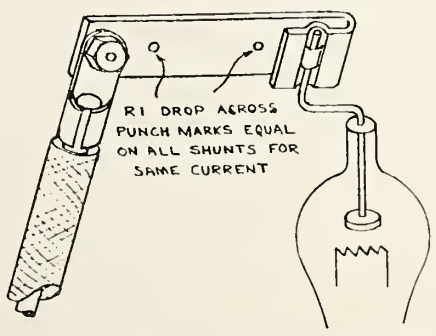
4. Popping or swishing noise in the sound when the scanning drum is rotated with no film in the machine is due to the edge of the sound drum projecting into the light beam. I suggest the following remedies—(a) Shim the sound drum bracket to give better clearance. or, (b) scrape the edge of the sound drum with a narrow file ground to a sharp edge.

5. When the belt runs off in flat pulley drive machines and assuming that the pulleys are in satisfactory shape, check the axial alignment of the motor and drive shafts and shim the motor to a position where the belt runs true.—L. P. Work, *JIM HANDY.*

How to Test Arc Lamp Tungars

Frequently an arc lamp will commence flickering due to a defective tungar bulb. It then becomes a case of replacing each bulb separately to locate the bad tungar and where 4 to 6 tungar bulbs are used in a rectifier this takes an appreciable period of time, and often a good bulb may be discarded.

I suggest a shunt made of German silver or monel metal (see sketch below),



be connected between the pig tail of the bulb and its lead, having 2 punch marks accurately spotted so that the IR drop between the marks would be the same for all shunts. The shunt would be of such length and thickness as to develop 10 m. v. at 15 amps. The projectionist could then take readings at each bulb; the defective bulb would read low or erratic.

A more elaborate scheme would consist of a panel mounted on each rectifier, containing a m.v. meter, and a switch for each pair of leads from the shunts, so that readings of each bulb could be read in succession.—P. Gruen, *ALTEC.*

Mercury Vacuum Tube Holder

A mercury vacuum tube holder for holding spare tubes in an upright position can be made from a piece of wire formed to hold the spare rectifier tube in a convenient place. The holder consists of a piece of wire formed into a loop into which the tube is slipped and held in an upright position until needed. One end of the wire is formed into an eyelet and fastened under a screw which holds the filters capacitors of the field supply on the PG-140 series rack.—G. Horton, *RCA.*

Signal Discs for Blacking Out Punch Holes in Film

Recently I ran across a projectionist who was carefully blacking out some punch holes in the film. For this purpose he used Dennis' "Signal Discs," size number 12, which may be purchased in boxes of 200 for only ten cents. These discs are very easy to apply and while they show up on the screen they are an improvement over the big white holes that appear when the film is not covered.—M. Rushworth, *RCA.*

Improvised Blackboard

A convenient way for marking notations on film cabinet doors is to paint a rectangle on the doors with blackboard paint, obtainable in small cans at regular paint stores. Use regular chalk for writing notations of "reel numbers," "news," "shorts," etc. The paint dries overnight and the surface lasts a long time. The idea may be further extended by painting a "blackboard" on a convenient surface near spots, effect machines, etc., for cue markings for stage shows and many other uses.—W. J. Zeidlik, *ALTEC.*

The PEACETIME Engineering Outlook

By *D. E. HYNDMAN*

PRESIDENT, SOCIETY OF MOTION PICTURE ENGINEERS

MANY articles have been published extolling the miracles of scientific and engineering progress made because of research and development done to produce new and effective materials for World War II. Some have stressed the panacea that will exist now that peacetime has arrived pointing out special new gadgets made of plastic, light-weight metals, special new-type materials, etc.; even to predicting the early availability of wrist watch radios, book-size television sets, gadgets that do all housework, and even atomic powered automobiles.

Perhaps some of these Buck Roger developments will materialize, but let us not be led to expect too much—to expect more than the scientist, engineer, and producer are capable of giving. Let us remember that reliability and quality of performance require careful study, often considerable time, and ample proving tests.

This type of careful study and investigation of problems or projects is fully representative of the high engineering standards practiced in the past and planned for the future by the Society of Motion Picture Engineers.

The Society is an engineering organization of a group of individuals associated in general partnership to conduct a business paying no salaries to officers or members, but operating on a non-monetary principle to recommend engineering procedures, to guide to some extent research and development, to encourage improvement, and to lead standardization in the Motion Picture Industry.

From the initial organization of the Society in 1916 it has led the Motion Picture Industry to accept technical improvements that have been major contributions for continually increasing the efficiency of operation in production, distribution, and exhibition, and patronage at the box office.

In cooperation with those interested, the Society plans:

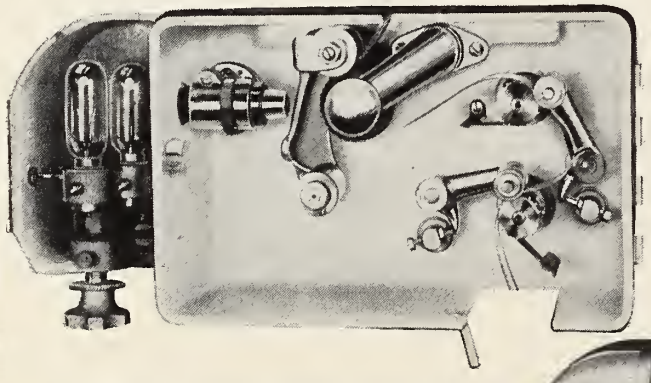
(1) Group engineering at an accelerated rate on problems and projects directly related to production, distribution, exhibition, film, equipment, accessories, etc.

(2) Further detailed work on the interrelations of the television art and the entertainment field of motion pictures, involving such specific projects as: studies of frequency allocation and band width requirements in relation to screen definition, private addressee systems, study of problems in installing and operating television equipment in theatres, follow-up on hearings before the Federal Communications Commission, etc.

(3) More efficient work in standardizing procedures, methods, data, specifications, equipment, and the like, which brings economy to production, distribution, and exhibition.

(4) Careful supervision of all engineering and technical projects on Motion Pictures with the American Standards Association and any International Standardizing Groups in order to maintain the Motion Picture Industry in a position to steer equipment design throughout the world. This would tend to assure that American Motion Pictures could be distributed or exhibited anywhere. Much of this cooperative work has been done in the past, but as a result of the war it is imperative that this international cooperative engineering be followed to the fullest extent.

(5) Correlating, assembling, editing, and original preparation of material for



Six Reasons

WHY YOU SHOULD HAVE THE NEW Syncrofilm "400" DYNAMIC SOUND HEAD

1—The first patented Dynamic Filter consisting of a combination heavy and light flywheel.

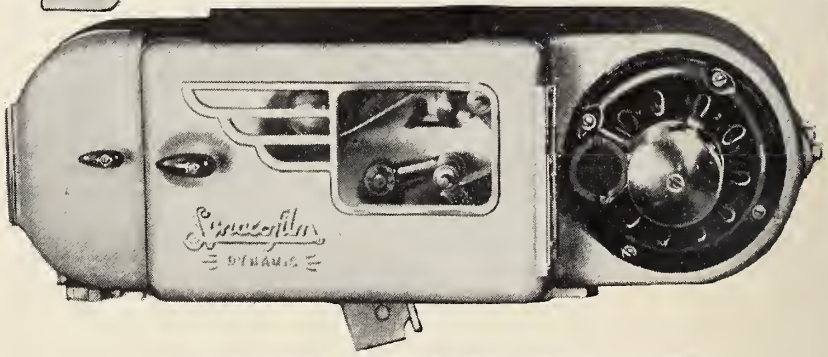
2—The greatest perfection in the latest development of cylindrical lens optical system.

3—A new sound sprocket effecting a more smooth pulling film motion than the conventional type sprocket.

4—Dual exciter lamps to avoid interruption in the projection performance.

5—Materials of the highest quality, tested and put together by the skilled staff that produced precision tools for our Armed Forces.

6—Direct Motor silent chain drive for smooth positive action.



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W. E. EXPORT MANAGERS HOLD MEETINGS IN NEW YORK

Thirty managers of the Western Electric Export Corporation, meeting in New York at the Waldorf-Astoria Hotel Oct. 1 to 12, were brought up to date on new equipment and policies of the organization. The gathering was one of the most important ever held by the corporation, due to the wide foreign field that is being visioned. Many foreign markets, it was pointed out, are hungry for new equipment to replace obsolete installations and to replace war losses.

In addition to the thirty foreign managers many representatives of the headquarters staff were on hand, headed by T. K. Stevenson, president and E. S. Gregg, vice president. Mr. Gregg, in one address to the managers, pointed to the bright prospects of applying wartime research to the modernization of movie theatres in all the countries of the world. He declared that the latest designs of sound equipment will make it possible for exhibitors to reach new high standards of excellence.

The managers, many of whom visited this country for the first time, were highly interested in new sound equipment on display at the Waldorf, as well as other products including a full line of theatre accessories, booth equipment, the Fastax camera, acoustic instruments, the new Model 63 hearing aid and other items.

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needed engineering reference books and/or reports on:

(*a*) *Cinematography,*

(*b*) *Sound Recording and Reproduction for Motion Pictures,*

(*c*) *Motion Picture Laboratory Practice,*

(*d*) *Film Exchange Practice,*

(*e*) *Motion Picture Process Photography,*

(*f*) *Motion Picture Projection,*

(*g*) *Motion Picture Theatre Engineering,*

(*h*) *Preservation of Motion Picture Film for Valuable Record Purposes,*

(*i*) *Theatre Television Installation and Operation.*

These books or reports are urgently needed not only in the Industry but also as text books for the teaching of courses on Motion Pictures in colleges and universities. Such courses are now proposed in answer to numerous requests from members of the Armed Forces as well as from civilians who, in past years, have often asked the Society to recommend institutions giving courses in Motion Picture Production, Distribution, and Exhibition.

Mutual understanding and close cooperation of those who appreciate these problems in the related fields of production, distribution, and exhibition are necessary to bring about engineering advances which might otherwise lay dormant for many years. Let us work together to make American Motion Pictures continue leading the World.

your light may be out...

Winds and storms cause breakdowns in power...but not for long. No matter what the weather, the line man is soon at the scene of trouble, repairing the damage. Master technician, he does his work day in and day out, his only glory the satisfaction of doing a tough job well.

But Not For Long!

The Altec Service Engineer, too, is another unsung public servant. He's a key link in the entertainment chain between a Hollywood sound stage and the local movie screen. Backed by a large staff of engineering experts, he works closely with the projectionist to keep booth equipment working in A-1 condition.



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PARTNERS IN PUBLIC SERVICE



THE SERVICE ORGANIZATION OF THE MOTION PICTURE INDUSTRY

LETTERS TO THE EDITOR

I. P. Tops with Projectionists

To the Editor of I. P.:

Please note change of address. I am heading for home so mail future issues of the magazine to New Castle, Penna., instead of in care of the U. S. Army.

Thanks a lot for the INTERNATIONAL PROJECTIONIST. It is still tops with me and I guess all the other projectionists feel the same way about it. I look forward to the copies each month and would feel lost without the magazine. Again, thanks a million.

JOHN J. GREGORICH
APO, New York, N. Y.

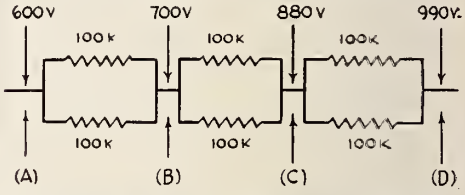
Ohm's Law Triumphant

To the Editor of I. P.:

Some months ago while engaged in tracking down some trouble in a radar set I was obliged to conclude that Ohm's Law had been repealed, or at least amended.

As I remember the circuit values, a bleeder resistance was constructed parallel-series as shown in the diagram below. Now, as the current throughout the series branches is the same, I placed a milliammeter at the 600v. point, and read 2 mils. Thus I proved that the resistors between the 700-880v. point and the 880-990v. point had changed in value. Triumphantly substituting resistors measuring a pat 50,000 ohms in parallel, I was amazed to find current unchanged and voltage values the same.

Possibly the wattage dissipation is too great for both the original and replacement resistors, so a calculation proceeds



(The voltage at C reads 880v. instead of 800v., and the voltage at D reads 990v. instead of 900v.).

with the figures .002 and 180 (largest measured drop in voltage), which indicates that a rating of 1 watt provides adequate safety factor over a requirement of .36 watt. The resistors in use are 2-watt, of good manufacture, tolerance ± 5%, and measure on the nose in resistance. It was at this time that I said Ohm's Law had been repealed.

That is all there is to the story—except that a voltmeter with an accurate 1000-volt scale put old man Ohm back in business. With a good meter, we ticked off 600, 700, 800, and 900 volts, all as should be, and Kirchoff and I slept soundly that night.

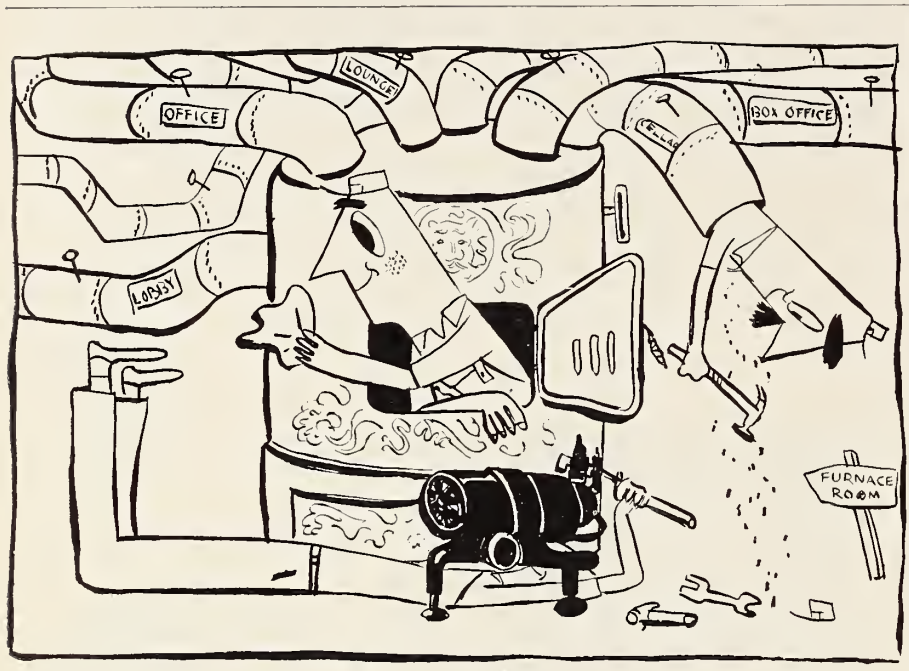
JOSEPH F. HOLT
Camp Maxey, Texas.

EDITOR'S NOTE: *The results obtained were unusual because the meter read too high. Usually the meter will read too low, due to the loading of the high resistance circuit, by a low resistance meter. Best results are always obtained when a very high resistance meter, such as a* 20,000 *ohms per volt meter, or a vacuum tube voltmeter is used for such measurements. The final results which were obtained with a good meter prove that Ohm's Law, like the automobile, is here to stay for a while.*

V-Belts for Take-ups

To the Editor of I. P.:

I have long wondered why projector manufacturers do not use an endless V-belt on their take-ups. Before the war I operated a Simplex and the chain take-up never gave us any trouble. Later, in the Army, I worked for several weeks with Simplex E-7s. The machines were practically new but one night the leather take-up belt broke during a show. Why



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was the change made from a chain to leather belt on the E-7? Was it done to reduce noise? Certainly a chain drive is more positive than a leather belt!

I understand that the Motiograph projectors also are equipped with leather belts, as are the Century projectors.

Wouldn't a good V-belt, even without having any provisions made for its adjustment, run longer and with less attention than a round leather belt? It seems to me that with an adjustment to keep the slack out this belt would last for years, considering how relatively slow it turns.

A V-belt is used on auto engines to drive the water pump and generator, and from past experience I know for a fact that this belt will not give any trouble if fitted properly and is given a reasonable amount of care.

For the past ten years I have been a regular reader of I. P. and I don't remember reading of any projector using a V-belt or anyone suggesting its use. If there is any particular reason why manufacturers do not use V-belts, I surely would like to know.

In the 2½ years I have been stationed here I've had more near-stops from a slipping take-up belt than from all other causes combined. If my suggestion has any merit, will you be good enough to pass it along to the proper parties.

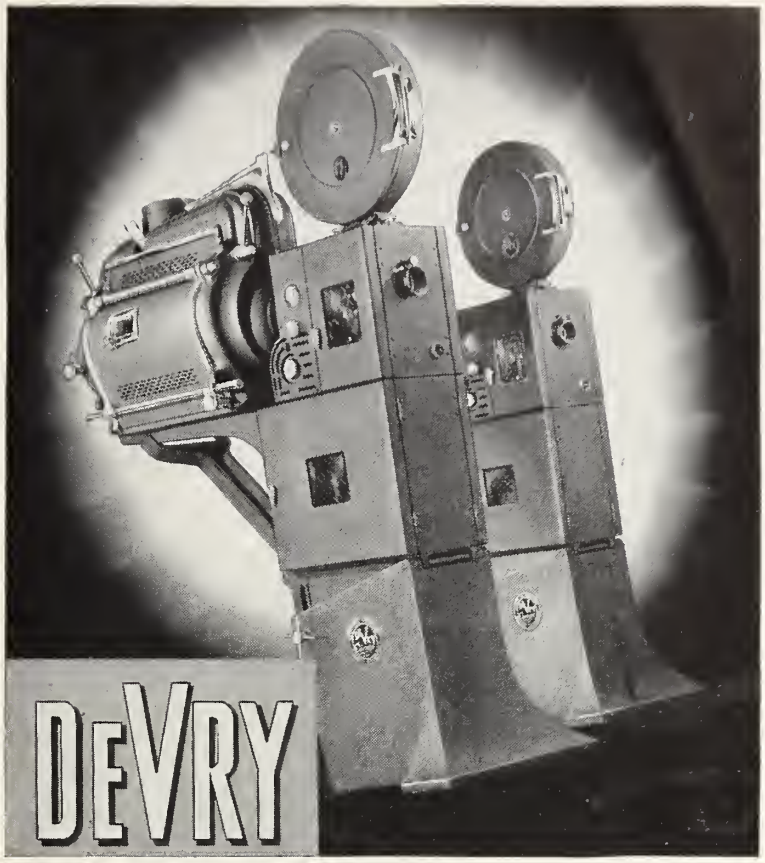
CPL. GEORGE A. WAGNER
APO, New York, N. Y.

EDITOR'S NOTE: *The reader's letter was passed on to several projector manufacturers for comment. Motiograph's reply to Cpl. Wagner's suggestion appears elsewhere in this issue in an article titled "Chains, Belts, or Gears?" Mr. H. Barnett, director of engineering for International Projector Corp. seems to agree with Wagner and his comments follow:*

"There would appear to be no clear cut reason why V-belts have not been used previously on film take-up drives. There are some disadvantages which existed in the past with regard to their general application. Until a few years ago the materials used in the manufacture of V-belts were not satisfactory for applications where oil is present. Also, in the matter of replacement and repair of the drive belt the advantages of the round belt are obvious, particularly in connection with districts where supply of such items may be extremely limited. We recognize that these disadvantages have been largely overcome due to recent improvements in the V-belt, and it is likely that extensive use will be made of V-belt drives in future developments."

NEW ALTEC CONTRACTS

Altec service and parts agreements have been renewed with the Schine Circuit, Inc., according to Bert Sanford, Jr., Altec New York district manager. One hundred and twenty-nine theatres throughout the Atlantic seaboard and Middle Western States are involved. L. J. Hacking, New England district manager, announces that B & Q Associates have signed agreements with Altec for booth replacement parts for theatres in Brookline, Quincy and Rockland, Mass.



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A PROUD NAME in the motion picture world, DeVRY is justly proud of its new 35mm motion picture projectors for which orders are now being accepted. Into these streamlined, rugged, durable and trouble-free essentials to audience satisfaction has gone a wealth of engineering knowledge and experience. Back of their sterling performance in the theater, are new manufacturing techniques, improved machinery, broadened facilities—and the skilled craftsmanship of men who have earned their FIFTH Army-Navy "E" award for excellence in the production of motion picture sound equipment. RESULT: a theater projector that exceeds generally accepted commercial standards in every respect. Coupon will bring you facts of importance.

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SNODGRASS JOINS W. E. AS DIVISION GENERAL MANAGER

F. R. Lack, vice-president of Western Electric Company, announces that William E. Snodgrass has become general manager of the company's hearing aid division. Mr. Snodgrass formerly was executive vice-president of the Dictograph Products Company. His appointment followed in less than a week the Western Electric announcement of their new Model 63 hearing aid which climaxes 63 years of research and development in sound transmission.

Mr. Snodgrass in accepting the appointment said: "The present day hearing aid represents nearly three-quarters of a century of scientific research and development in the field of electrical sound transmission. It is an instrument of great precision and one which has become an essential for a full and useful life for countless thousands."

EDUCATIONAL FILM GUIDE ISSUED BY BELL & HOWELL

Bell & Howell announces a new comprehensive description and classification of 2,047 educational motion pictures, a guide to its Filmsound Library resources in the field. The work is a 112-page book, embodying novel cataloging devices intended to make easier the job of finding any film on any subject, the company points out.

Titles are grouped by subject matter, with related areas logically arranged in line with curricular subject areas. Sound, silent and color versions have common listings, but are clearly identified. There are 158 films in color; 450 are silent, of which 121 also are available in sound. Descriptions are factual and detailed, and there are many illustrations.

New supplementary catalogs now ready include a special list of war training films, one of films for church use, and another of classroom films for sale or lease. The entire set is being mailed free to Bell & Howell dealers and associated film libraries.

DUMONT TO INSTALL TELEVISION STUDIOS IN WANAMAKER'S

Three complete television studios will be installed by Allen B. DuMont Laboratories, Inc., in the New York main store of John Wanamaker, according to an announcement by Charles R. Shipley, president of the department store organization. These studios will be operated in conjunction with the DuMont television station WABD. Mr. Shipley declared that "we plan to convert the portion of the store now housing the Auditorium into a virtual 'television city.' More than half a million cubic feet of space is being set aside for the project."

The DuMont installations will include one studio, 50 by 60 feet in size, with a 50 foot ceiling, two smaller studios, a telecine room, housing a full component of television motion picture cameras, and facilities for art work, property storage, dressing rooms and extensive accommodations for live audiences. Company officials believe it will be only a few years before television programs originating in the studios will be received in living rooms in homes throughout the country.

DuMont plans thorough experimentation with illumination for the studios. Lights will be suspended from a steel grid in the ceiling and also from the balcony. Construction will be completed early in December, at which time an elaborate initial program will be scheduled.

BETTER SOUND DUE ACCORDING TO ALTEC SURVEY

Many exhibitors have extensive plans for fall renovations in theatres throughout the country, according to reports from Altec field personnel, with special attention being given to the improvement of sound reproducing equipment in order to take advantage of improved recordings developed by West Coast studios.

Surveys now are being made to establish the optimum output quality of present sound reproducing systems so that all benefits achieved from higher efficiencies of new loudspeaker systems may be retained for better over-all sound results. It was pointed out that this renewed interest for better sound on the part of theatre owners has resulted in many new deals being consummated for Altec Service. Among these are:

Lowrey, Russellville, Ark.; New Royal, Atkins, Ark.; Petit Jean, Merilton, Ark.; State and Palace, Thomasville, N. C.; Neeley, Dighton, Kan.; Lyric, Cass Lake, Minn.; Wahoo, Wahoo, Neb.; Downtown Music Hall, Los Angeles, Cal.; Bay, Almeda, Cal.; Liberty, Stockton, Star and Lincoln, Stockton, Calif.; Point, Hunterspoint and Star, Reedley, Calif.

Also the Palace, Charlevoix, Mich.; Norval, Cleveland, O.; Cameo, Detroit, Mich.; Avalon, McLean, Tex.; Rex, Beckville, Tex.; Woodlawn, San Antonio, Tex. Casino, Boston, Mass.; Mt. Herman School, Gill, Mass.; Mt. Baker, Seattle, Wash.; Inwood, Forest Hills; Pix, White Plains and Beverly Hills, New York City. Also, the Criss Theatre, Barboursville, W. Va.

GoldE

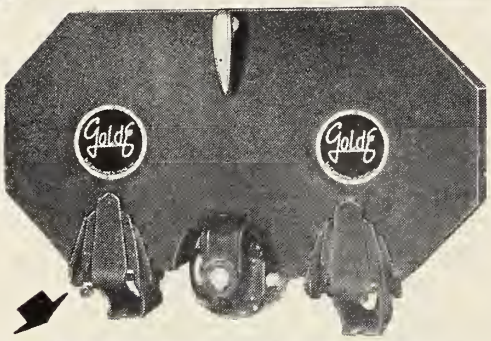
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IN THE SPOTLIGHT

(*Continued from page* 17)

about the projection room—the real fire-trap of the theatre. They do not seem to be aware of the potential hazards found in every projection room, and that the hazards are multiplied particularly in those theatres having a one-man projection shift.

To the ever mounting list of projection room fires, add the Hugo Theatre in Hugo, Colo., and the Cameron Theatre, in Denver, Colo. C. W. Inman, owner and projectionist at the Hugo Theatre, and Bob Ray, projectionist at the Cameron Theatre, suffered injuries from burns and cuts while trying to check the flames from spreading to other parts of their theatres. However, since the quick actions of these men averted what might have turned out to be catastrophes, nothing further was done and we doubt if anything will be done to lessen the dangers of projection room fires. The fire laws were strictly enforced in Boston *after* the Cocoanut Grove disaster of three years ago when hundreds of people lost their lives—it seems that each city will have to experience a similar tragedy before the officials wake up to the dangers of projection room fires.

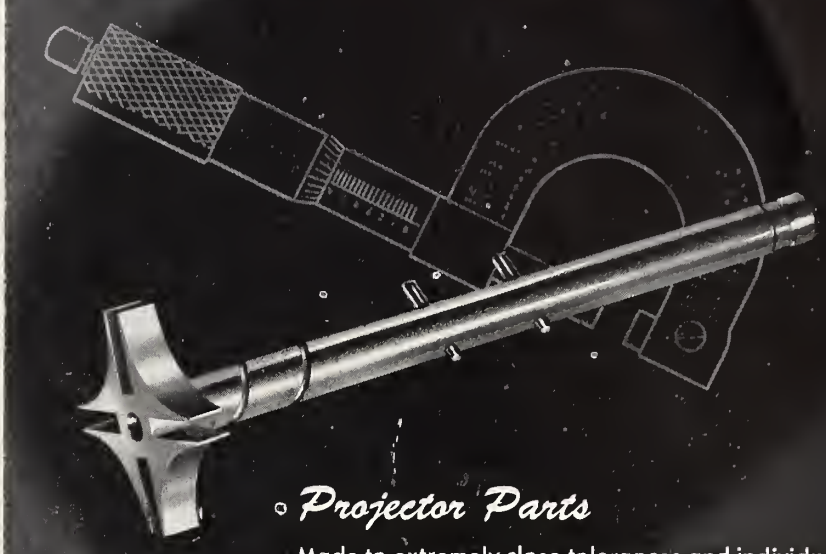
● John A. Shuff, business agent of Local No. 364, Akron, will remember his 45th birthday for a long time to come. More than two hundred friends, many of them from out-of-town gathered at the Akron Hotel on the 25th of September in celebration of Shuff's 45th birthday. Scores of congratulatory messages were received from union officials from many states who were unable to be present at the party. Judge Oscar Hunsicker of Common Pleas Court in Akron, who acted as master of ceremonies and presented all out-of-town guests also took part in the cutting of the huge birthday cake. A buffet supper was served in the banquet room of the hotel and a good time was had by all.



John A. Shuff

● We are happy to report the success of the officers of Local No. 671, Canton, Ohio in getting the exhibitors in their jurisdiction to agree to the inclusion of the vacation with pay clause in the new contracts. Contracts have already been signed with the first-run houses and approved by the W. L. B. which gives each member working over one year a one-week vacation with pay, with an

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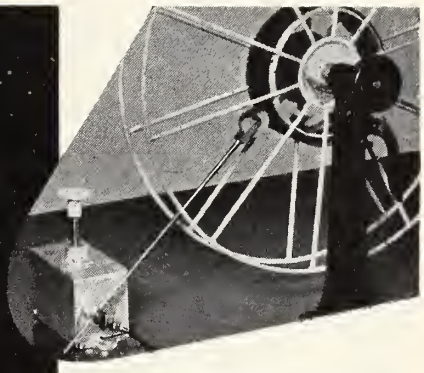
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"THERE'S A BRANCH NEAR YOU"

(Continued from preceding page)

additional day for each year until the fifth year, when he will be entitled to two weeks' vacation with pay. All contracts are retroactive to September 1, 1944. Agreements have been reached with the neighborhood houses on the granting of vacations with pay, pending final approval of the W. L. B. Nice work, boys.

● J. H. Febl, secretary-treasurer of Local No. 183, Beaumont, Texas, sent us a copy of the weekly bulletin put out by the Beaumont Rotary Club wherein appears a tribute paid to Sam Medile, member of the local, for his part in putting on a show for the Rotarians, to wit:

". . . But nothing I've ever said about moving pictures as material for a Rotary program was ever meant to apply to a program such as we had last week—professionally made pictures, made for exhibition and not for advertising purposes, exhibited from a professional projector operated by a professional projectionist who knows his stuff, understands lighting, sound, and proper projection. . . . The projectionist whose ability contributed so greatly to our enjoyment of the films was Mr. Sam Medile, one of the regular projectionists at the Jefferson Theatre. . . ."

Take a bow, Sam.

● A four-year contract retroactive to September 1, 1944, plus two weeks' vacation with pay, and a 2½% wage increase were the terms agreed upon in the negotiations between the officers of Cleveland Local No. 160 and the owners of 70 neighborhood theatres. Prior to the signing of the contract, these exhibitors were opposed to the two-man projection shift. However, the new contract calls for the continuation of the two-man shift and Mr. Exhibitor can now pack his crying shawl in moth balls until the expiration of the contract.

Congratulations to Harland Holmden, business manager, and Victor Welman, secretary, for their able leadership.

● The bone of contention in the recent negotiations between St. Louis Local No. 143 the theatre owners seemed to be the exhibitors' opposition to the two-man shift in the projection room. However, when it was pointed out to them that a city ordinance was passed in 1937 making it mandatory, for safety and other reasons, for the two-man shift, the exhibitors gave up the fight on this point. They also agreed to two weeks' vacation with pay.

Other difficulties were eventually ironed out and after about 30 days of negotiations new contracts were signed and for the next six years there will be peace and harmony between the exhibitors and Local 143 (we hope).

Serving on the committee for the local were Harvard O'Laughlin, president; Leo Canavan, vice-president; Harry Barco, business agent; Fred Kelsick, secretary, and executive board member Harry Wittee. They all did a very fine job in the negotiations, particularly Harry Barco who is credited with guiding the committee through the troublesome period.

● Walter Croft, Kansas City, Mo., Local No. 170 business agent, announces the signing of a new two-year contract calling for a $2.50 per week increase for the

Eight kinds of STEEL are used in building the TransVerteR

Therein lies one of the "secrets" of the many years of service obtained through having the Transverter in YOUR Projection Room.

To give you these years of service, the best type of steel is used for each particular part. 1. Hot rolled, high carbon, shaft steel; 2. Low carbon steel for frame rings; 3. Bessemer screw machine stock; 4. Silicon alloy steel to prevent aging magnetically; 5. Annealed low carbon sheet steel; 6. Deep drawn stock for formed parts; 7. Low carbon structural shapes for bases and other component parts; 8. Nickel chrome alloy steel used in bars.

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DEVRY ISSUES SUPPLEMENTARY BOOKLET ON 35-MM

DeVry Corporation, of Chicago, has issued a special eight-page supplement in two colors covering its new 35-mm theatre projector with built-in precision soundhead. This supplement, which is now available without cost, contains a page of illustrations and descriptive data covering DeVry's low distortion amplifiers.

"Not merely a new projector, but a new and improved type of motion picture sound projector," epitomizes the supplement's content, according to a company announcement.

TO MAKE SERVICE EQUIPMENT AVAILABLE FOR SCHOOLS

The Surplus Property Board announces that when movie films and projectors used by the Army, Navy, and other government agencies are no longer needed for war services they will be made available at low cost to schools which are unable to afford them at retail prices but which have facilities and personnel to use them effectively. However, SPB said that no distribution of movie equipment to educational institutions whose financial resources would permit them to buy equipment is being contemplated.

The program is in accordance with the SPB Act, which authorizes distribution of surplus goods for health and educational use on the basis of community need and public benefit. The United States Office of Education, Federal Security Agency, is the agency responsible for determining what communities have the greatest needs and the best plans for use of visual educational equipment.

While the number of films and projectors which will eventually become surplus is not known, approximately 40,000 16-mm sound projectors have been ordered by the military services so far. However, only a small percentage of these is expected to become surplus. SPB urges education officials and community leaders wishing to obtain the available equipment to outline programs for their effective utilization.

first year, with an additional $2.50 per week increase for the second year.

● "The Voice of the Projectionist," is what Harry Joslin, president of Miami Local No. 316, called this publication to a group of I. A. men at the recent theatre supply dealers and manufacturers convention in Chicago. Being a practical projectionist and an ex-I. A. official, we think we are qualified to speak for the craft. As a matter of fact, we believe that the seeds for a number of benefits now enjoyed by the craft were first planted in these columns. Thanks, Harry, it is good to know that our efforts are appreciated.

● Another old-timer has been added to the casualty list. Ferdinand Wise, member of Detroit Local No. 199 suffered a heart attack in the projection room of the Capitol Theatre and died on the way to the hospital. Wise was a veteran of World War I and a member of the American Legion. He was also a member of the Nightingale Club, Local 199 bowling club.



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No More Worry . . . No More Guesswork . . . No More Wrong Reels

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For perfect rewinding on 2000-foot reels.

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WESTREX SOUND SYSTEMS

(*Continued from page* 14)

all cases they are installed as a compact unit demanding little space.

Westrex Standard Sound System

In principle, the Westrex Standard sound system retains the major improvements of the more elaborate model but its design has been simplified to meet the requirements of theatres operating on a limited budget.

In the design of the Hydro Flutter Suppressor, two pad rollers, one above and one below the scanning drum, yield to compensate for variations in the pressure of the film. A light spring couples the rollers and their motion is cushioned further by the movement of a small piston in a special damping fluid. Careful laboratory measurements show a flutter content well within the standards set by the Academy of Motion Picture Arts and Sciences.

Threading is simplified by the spacious, well lighted scanning compartment, the absence of extraneous components (there is only one sprocket and two pad rollers in the path of the film) and a hand wheel mounted directly on the motor shaft.

The exciter lamp is prefocused and shock mounted. It can, however, be adjusted both vertically and horizontally should necessity require.

The amplifiers for the Standard system and its electronic power supply are housed in one cabinet. Negative feedback—a development of Western Electric and Bell Telephone Laboratories—minimizes harmonic distortion to a value of less than 2%. All components likely to be affected by tropical conditions of heat and high humidity have been treated protectively.

The Westrex Standard uses a duplex loudspeaker in which a miniature high frequency multicellular horn is mounted coaxially with the low frequency speaker. Not only does this speaker combination yield higher efficiency in the conversion of electrical energy to sound but, of greater importance from the audience point-of-view, it results in a striking increase in "screen presence."

GOOD MARKET SEEN IN NEAR EAST COUNTRIES

R. E. Gowar, manager of the Western Electric Company (Near East), believes that the Near East countries can provide a sharply expanding market for American movies and theatre and recording equipment. Mr. Gowar, who recently returned from Egypt, states that this market depends on early solution of the monetary exchange problems and the resulting modification in existing import restrictions.

Returning to New York to attend the first international conference of Western Electric Export Corp., foreign managers, Mr. Gowar said that the influence of the cinema, the radio and the large numbers of English speaking military personnel in the Near East has sharpened the interest of native peoples in English-speaking movies. "Many people of my own acquaintance," he declared, "have learned English since the war began, and that seems to be a general trend." He also pointed out that there is a large untapped market for American films having sound tracks dubbed in native languages.

RADIO RECEPTOR OFFERS LINE OF SELENIUM RECTIFIERS

As an addition to their array of industrial electrical equipment, Radio Receptor Company, Inc., 251 West 19th Street, New York City, announces a line of *selenium rectifiers* designed to meet every requisite for a modern a.c. to d.c. conversion unit.

This new line embraces a wide range of units—from 25 mils up to capacities of hundreds of amperes—thus offering an efficient unit for every industrial application, for all combinations of voltage and current outputs and for various types of circuits. To name only a few specific applications, selenium rectifiers are used extensively for battery charging, relay circuits, welding, electroplating, magnetic devices, telephony and railway signaling.

BOOK REVIEW

Projectionists whose interest in their work goes belond the daily routine will find an unusually complete and authoritative discussion of electrolytic condensers in a new book entitled "The Electrolytic Capacitor" published by the Murray Hill Books, Inc., of New York and Toronto.

The physical and chemical construction, materials used, and electrical action of these condensers all are thoroughly described and amply illustrated. Three chapters are devoted to trouble-shooting—to troubles, causes of troubles, electrical tests and emergency repairs for electrolytic condensers.

The author, Alexander Georgiev, holds nineteen United States patents covering inventions in electrolytic condensers.

His book is descriptive, rather than mathematical, simply written and easily read. Its comprehensive and authoritative nature entitles it, in the opinion of this reviewer, to an honored place in any private collection of books dealing with the technology of modern projection. A. N.

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STATEMENT OF THE OWNERSHIP, MANAGEMENT, CIRCULATION, ETC., REQUIRED BY THE ACTS OF CONGRESS OF AUGUST 24, 1912, AND MARCH 3, 1933,

Of INTERNATIONAL PROJECTIONIST, published monthly at New York, N. Y., for October 1, 1945.

State of New York } ss.
County of New York }

Before me, a Notary Public in and for the State and county aforesaid, personally appeared R. A. Entracht, who, having been duly sworn according to law, deposes and says that she is the Business Manager of INTERNATIONAL PROJECTIONIST and that the following is, to the best of her knowledge and belief, a true statement of the ownership, management (and if a daily paper, the circulation), etc., of the aforesaid publication for the date shown in the above caption, required by the Act of August 24, 1912, as amended by the Act of March 3, 1933, embodied in section 537, Postal Laws and Regulations, printed on the reverse of this form, to wit:

1. That the names and addresses of the publisher, editor, managing editor, and business managers are:

Publisher, International Projectionist Pub. Co., Inc., 19 West 44 Street, New York 18, N. Y.

Editor, W. L. Lightfoot, 19 West 44 Street, New York 18, N. Y.

Managing Editor, None.

Business Manager, R. A. Entracht, 19 West 44 Street, New York 18, N. Y.

2. That the owner is:

International Projectionist Pub. Co., Inc., 19 West 44 Street, New York 18, N. Y.

R. A. Entracht, 19 West 44 Street, New York 18, N. Y.

3. That the known bondholders, mortgagees, and other security holders owning or holding 1 per cent or more of total amount of bonds, mortgages, or other securities are: None.

4. That the two paragraphs next above, giving the names of the owners, stockholders, and security holders, if any, contain not only the list of stockholders and security holders as they appear upon the books of the company but also, in cases where the stockholder or security holder appears upon the books of the company as trustee or in any other fiduciary relation, the name of the person or corporation for whom such trustee is acting, is given; also that the said two paragraphs contain statements embracing affiant's full knowledge and belief as to the circumstances and conditions under which stockholders and security holders who do not appear upon the books of the company as trustees, hold stock and securities in a capacity other than that of a bona fide owner; and this affiant has no reason to believe that any other person, association, or corporation has any interest direct or indirect in the said stock, bonds, or other securities than as so stated by him.

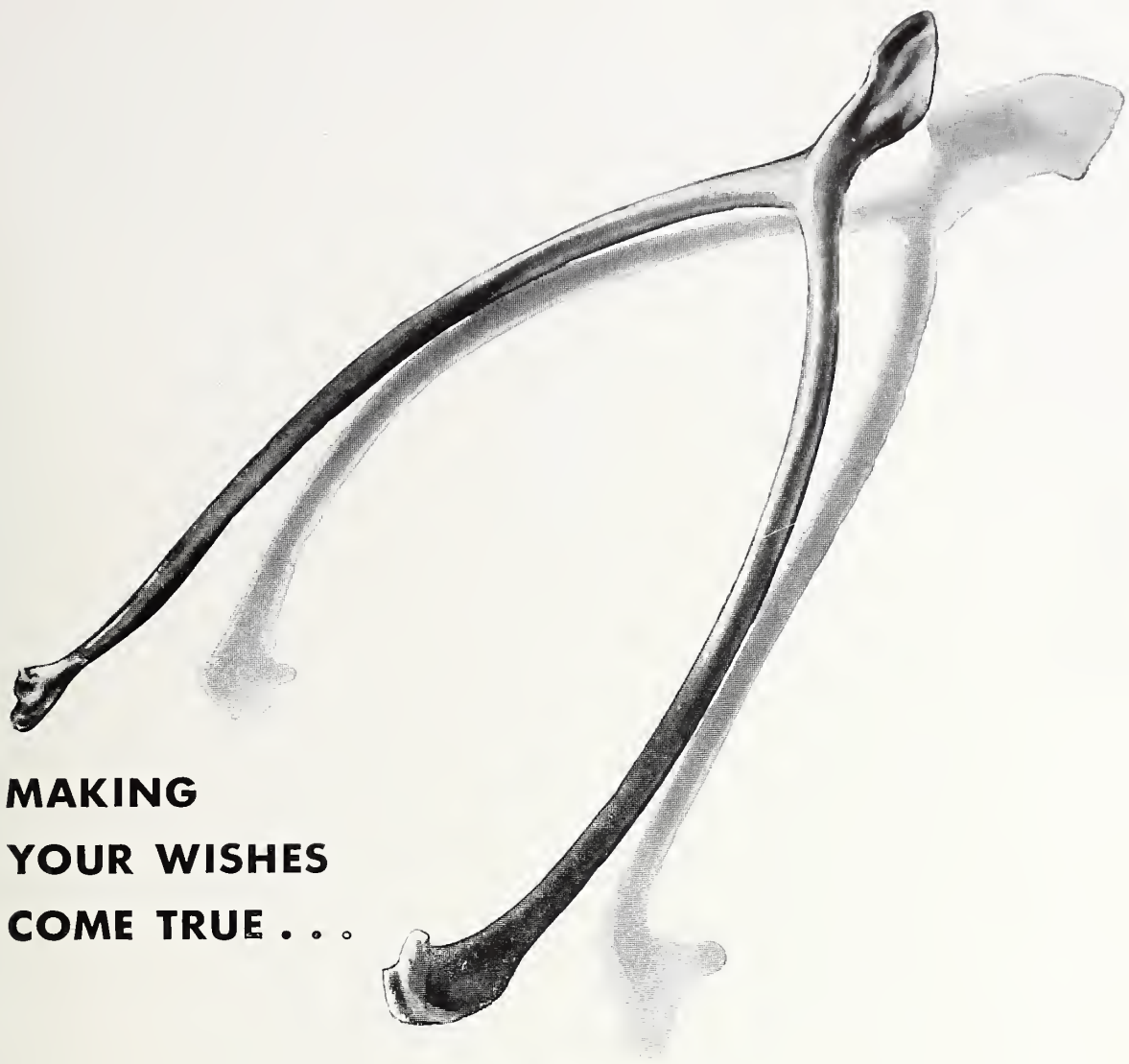
R. A. Entracht, Business Manager

Sworn to and subscribed before me this 24th day of September, 1945.

(Seal) BERNARD SCHWARZ

Notary Public, New York County Clerk's No. 185, New York County Register's No. 196-S-7.

My commission expires March 30, 1947.



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INTERNATIONAL PROJECTIONIST

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PROJECTION AND SOUND DEPARTMENT

August 8th, 1945.

Mr. Earl Hines, President,
International Projector Corporation,
90 Gold Street,
New York City.

Dear Mr. Hines:

In a letter to your Company dated February 16th, 1938, after ten months of practical operation of Simplex E-7 mechanisms in our Capitol Theatre, New York City, I wrote as follows:

"We have watched the operation of these mechanisms very carefully since they were installed and we find that they deliver at least 15% more light to the screen with considerably less heat at the aperture, and the definition has been improved immensely."

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"Further, I feel that the design of the E-7 mechanism affords economy with improved results not heretofore obtainable with any other mechanism."

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DIRECTOR OF PROJECTION
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CONTINUED USE FROM FOUR TO FIVE YEARS

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But how much are we willing to do about it?

Are we willing to pay for bringing them back? If we are, we'll buy *extra* Bonds in the Victory Loan.

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THEY FINISHED THEIR JOB—
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VICTORY LOAN

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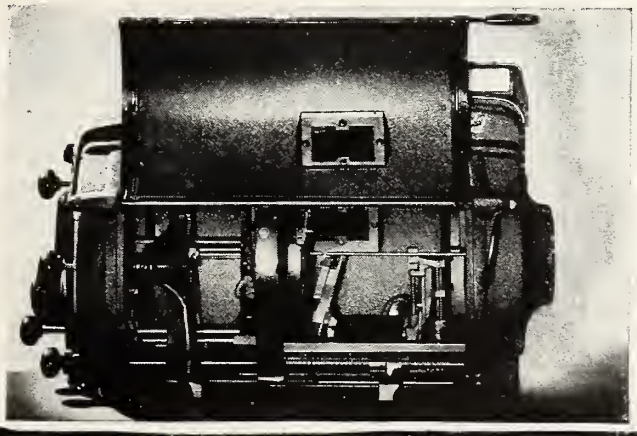
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deliver the snow-white light which is absolutely essential to the satisfactory projection of Technicolor pictures. The light of the low intensity lamp is yellow by comparison and in projection changes the color values of the film.

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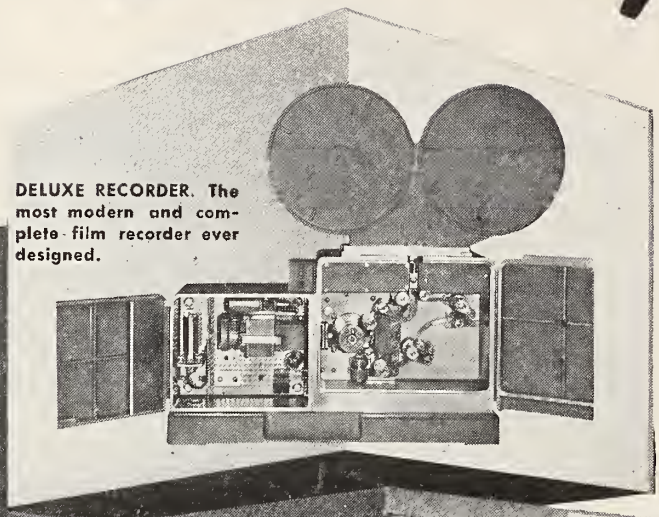
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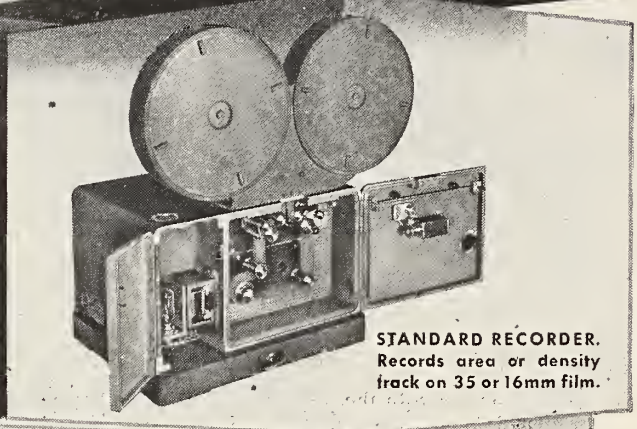
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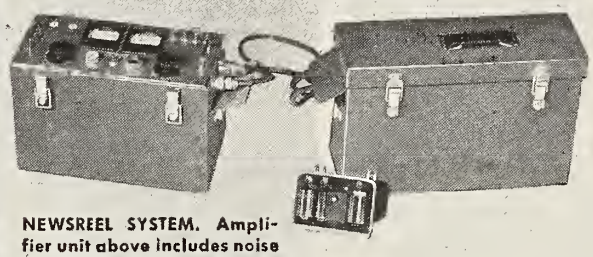
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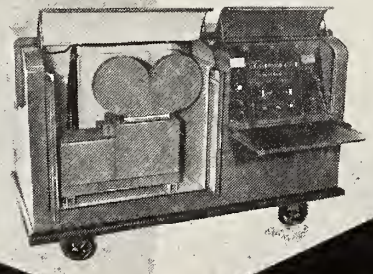


STANDARD RECORDER. Records area or density track on 35 or 16mm film.



NEWSREEL SYSTEM. Amplifier unit above includes noise reduction and peak limiting features; Power supply and modulator at right.

DELUXE RECORDING SYSTEM. Includes automatic control, which performs 8 starting or 3 stopping functions by the operation of a single switch.



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3. Maintenance is simple and inexpensive—all parts are easily accessible.
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5. Standardized units—select your own combination, add to it as required.

Buy all the Victory Bonds you can —and hold them!

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INTERNATIONAL PROJECTIONIST

With Which Is Combined PROJECTION ENGINEERING

W. L. Lightfoot, *Associate Editor*

Volume 20 NOVEMBER 1945 *Number* 11

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420

MONTHLY CHAT

YOU who helped win the war by the purchase of War Bonds necessarily must help win the peace by buying Victory Bonds. The current nation-wide drive means during the peace, just as was the case during the war, that every individual and every company must do his share in raising the huge total needed to finance our country and to make it possible to guard against inflation, the bugaboo that would minimize the value of every now solid dollar possessed by you or in the United States Treasury. Victory Bonds are sound investments and they are wise investments because they will assure continued prosperity and progress toward an even higher living standard for every single dweller within our borders .The return of 2.9 per cent on "E" bonds, incidentally, according to an analysis made by investment counselors and bankers is high in the list of best offerings being made for money today.

• • •

A projectionist who visited the theatre supply manufacturers and dealers conventions in Chicago last month at the Edgewater Beach Hotel. specifically to get first hand information on new equipment. has a bone to pick with I. P., which in its September issue suggested that those able to do so make the trip to the annual exhibits. He claims he "was badly fooled and disappointed" because displays had little to show in the way of improvements. We are sorry that our friend found his trip unprofitable from an educational standpoint. but we believe he is the one to blame. In a letter to I. P. he enumerates some of the equipment he saw, but does not mention several important exhibits where manufacturers had technicians and demonstrators on hand to explain them to visiting projectionists. Perhaps at forthcoming exhibits the associations will issue a directory of exhibitors, with room numbers and other pertinent information relating to displays, that would aid visitors who are interested enough in their work to spend their own time and money to make the trip.





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INTERNATIONAL PROJECTIONIST

VOLUME XX NOVEMBER 1945 NUMBER 11

THE PROJECTION LIFE OF FILM†

By *R. H. TALBOT*
EASTMAN KODAK COMPANY

THERE is no simple answer to the question "How many times can film be run through a projector?" It has been demonstrated many times that whereas one sample of film may become completely unserviceable after relatively few projections, another sample from the same roll of film may still be in serviceable condition after several thousand projections, depending on the conditions of operation.

It is true that there are certain qualities of the film stock itself which influence its wear life. Much could be written on the relation of the physical properties of the film (tensile strength, tear resistance, brittleness, *etc.*) to its durability. This relation, however, is one with which the film manufacturer is primarily concerned. The user of film is more concerned with those factors which greatly influence the wear life of the film he has at hand. This article deals with some of these factors.

If motion picture film were as dimensionally stable as steel, there would be no problem of the relative pitches of film perforations and sprocket teeth: the 2 pitches would always be equal and, consequently, several sprocket teeth would be in contact with the edges of the perforations at the same time. Actually, the pitch of the film perforations is changing more or less continually, owing to the loss of volatile materials and also to the dimensional changes which accompany variations in moisture content of the film. What then should be the pitch of the intermittent sprocket teeth?

The projector manufacturer has several choices in the design of the intermittent sprocket. He may make the pitch of the teeth such that there will be almost perfect mesh between film and sprocket when the film is freshly processed and less and less close mesh as the film shrinks, or he may make the pitch of the teeth such that there will be closer and closer mesh as the film ages. He may even choose a compromise pitch so that the film fits the sprocket best after the film has shrunk a portion of the total amount.

In order to decide which course is the best to follow from the standpoint of film wear, it might be of interest to review the behavior or movement of film on a sprocket in each of 2 cases. *Case I* the pitch of the film perforations is greater than that of the sprocket teeth, and in *Case II*, the pitch of the film perforations is less than that of the sprocket teeth.

Figure 1 shows the behavior or movement of film on a sprocket when the pitch of the film is greater than that of the sprocket. Note that the entering tooth strikes the edge of the perforation and shifts the film forward, the film traveling faster than the surface of the sprocket. This wedging-on of the film on the sprocket teeth produces a severe strain on and eventually a tearing of the perforations, and decreases the life of the film. This is the condition which exists today with the 0.935-in. diameter intermittent sprocket which was designed for films of much higher shrinkage than those in use at the present time.

Figure 2 shows the action of film on a sprocket when the pitch of the film is less than that of the sprocket. Here, the tooth that is about to leave the film does the driving, and the entering tooth engages the film without touching the edge of the perforation. The film is well seated at the base of the tooth when it makes contact with the driving face.

Theoretically, this condition should cause less wear on the film than the previous case, in which the pitches of the film and the sprocket are reversed. Actually, experiments show that lower wear may occur on either side of perfect

With the present scarcity of raw print stock, there is need for procedures which will substantially increase the useful life of the film on hand. Prints are rendered unserviceable by damage to the perforations, by mutilation of the edges in shipment, and by abrasion of the surfaces.

The means by which each of these types of film damage can be minimized (and in some cases almost entirely eliminated) are described herewith. The adoption of any one of these film conservation measures should double the useful life of a print. Universal adoption of all these measures could make possible several hundred bookings of a print.

† *J. Soc. Mot. Pic. Eng.*, Aug. 1945.

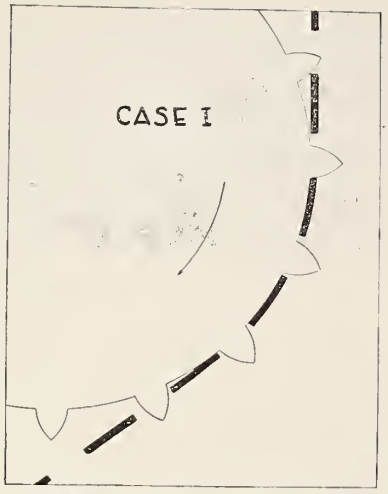


FIGURE 1. ***Action of film on a sprocket when the pitch of the film perforations is greater than the pitch of the sprocket teeth.***

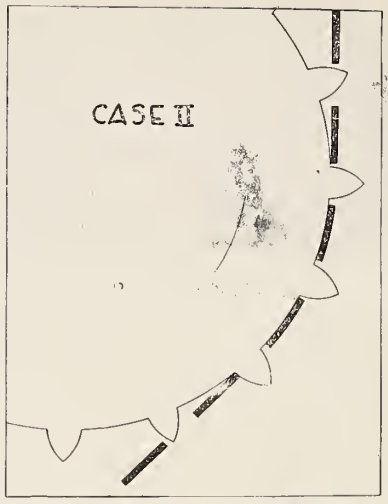


FIGURE 2. ***Action of film on a sprocket when the pitch of the film perforations is less than the pitch of the sprocket teeth.***

mesh, but, in general, so far as film wear is concerned, it is better to have the pitch of the film less rather than greater than that of the sprocket, as is the case today.

This fact is illustrated in Figure 3, which shows graphically the increased number of projections, plotted along the ordinate, as the shrinkage* of the film, plotted along the abscissa, causes the pitch of the film to become equal to, or slightly less than the pitch of the intermittent sprocket. The shrinkage of film necesary to give perfect mesh with a 0.935-in. sprocket is illustrated by the dotted line. All points to the left of this line represent Case I, in which the pitch of the film is greater than that of the sprocket, and all points to the right of the dotted line represent Case II, in which the pitch of the film is less than that of the sprocket.

Film Shrinkage

The actual number of projections required to produce complete breakdown of the film at the various film shrinkages will vary widely with machine conditions and the manner of operation. The maximum may occur under some conditions at several hundred to one thousand passages through the projector; under still better conditions, it may occur at several thousand passages.

Cases have been noted in which the maximum occurred at 22.000 passages. These figures were obtained by projecting short loops of film continuously on a simplified machine under carefully controlled conditions. The number of projections, therefore, are probably higher than can be obtained in practice because of the carefully controlled conditions under which such tests must be run. The main point is that there is a maximum and that this maximum occurs on a 0.935-in. sprocket at a shrinkage of film far greater than exists in any present-day motion picture positive film. (The amount of shrinkage of most motion picture positive film lies between 0.0 and 0.6 per cent during its normal projection life.)

Theoretically, the film is in perfect mesh with the 0.935-in. sprocket when it has a shrinkage of 1.2 per cent. and one might expect that the maximum should occur at this point. Frequently, it does occur close to this point, as indicated in Figure 3. However, it occurs often at a point well beyond the point of perfect mesh, as illustrated by Figure 4.

The reason for the failure of the maximum passages to occur at the point of perfect mesh has not been clearly established. The following is offered as a possible explanation: In Case I, in which the pitch of the film is greater than that of the sprocket, the film wedges on to the sprocket tooth, the film traveling faster than the circumference of the sprocket. Consequently, all of the driving action is accomplished by the sprocket teeth.

In Case II, in which the pitch of the film is less than that of the sprocket, the circumference of the sprocket travels faster than the surface of the film. In this case, a considerable portion of the driving action is accomplished by contact along the circumference of the sprocket as well as by the sprocket teeth, thus causing the number of passages to increase to a certain point as the pitch of the film becomes less than that of the sprocket.

Likewise, the failure of the maximum number of projections to occur at the calculated point of perfect mesh can be explained by the stretching of the film at the point of impact. If the film stretches upon impact of the sprocket tooth, and this appears to be a reasonable assumption, the effective pitch is greater than the calculated or measured pitch. Therefore, to obtain the optimum projections, the pitch of the film should be less than that required to give perfect mesh.

Optimum Projections

There is another and perhaps more satisfactory manner in which data of this type can be presented graphically. Since it is not the actual pitch of the sprocket and of the film, but only the difference between them which matters, we may express this difference graphically along the abscissa as the percent deviation of the film from the pitch of the sprocket, as in Figure 5. Zero on the abscissa, therefore, represents a perfect fit of the film on the intermittent sprocket in question, and, as before, all points to the left of the line represent Case I, in which the pitch of the film is greater than that

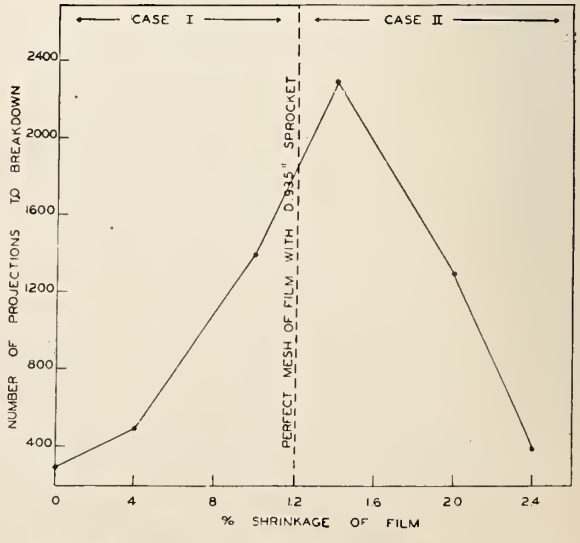


FIGURE 3.

Relationship between the pitch of the film and the number of projections necessary to produce film breakdown, using an 0.935-in. intermittent sprocket.

* The values along the abscissa are expressed as "per cent shrinkage" of the film, for convenience. Since it would be impossible to obtain shrinkages of such great range with the present motion picture films, many of the samples were perforated less than standard pitch on specially designed equipment in order to simulate films having these different shrinkages.

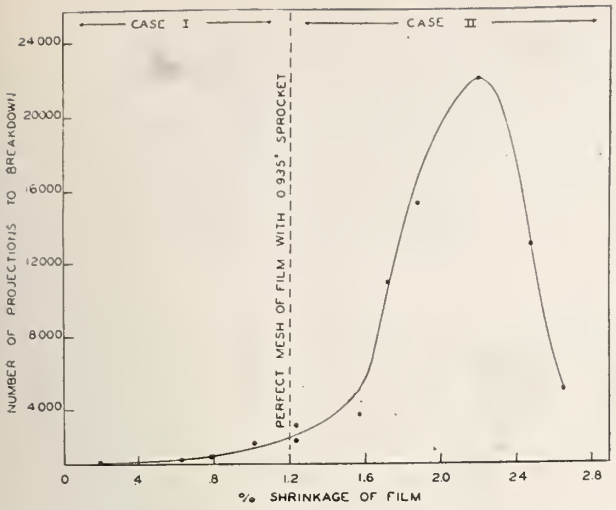


FIGURE 4.

Same as Figure 3 with the exception that the maximum number of projections does not occur at or near the point of perfect mesh of film and sprocket.

of the sprocket, and all points to the right of this line represent Case II, in which the pitch of the film is less than that of the sprocket.

Thus, films of any pitch whatsoever may be run on projectors with intermittent sprockets of different diameter and, if other factors are controlled, the results will still be comparable.

These principles have been recognized by film manufacturers and projector manufacturers alike. The approval of the 0.945-in. diameter intermittent sprocket and its adoption in 1930 as an American Standard came as a result of this general agreement. Why, then, has the 0.945-in. sprocket not been in general use in this country?*

The answer is that the projector manufacturers have been concerned over the possibility of increased wear of the sprockets, their fears being based on the theory then held. It is quite obvious that if we consider the film as a steel tape (Figure 1), the wedging action of the film onto the entering tooth should wear away the face of the tooth uniformly.

When, however, the pitches of the film and the sprocket are equal, or the pitch of the film is less than that of the sprocket, as in Figure 2, the entire wear should occur at the point of contact—or at the base of the tooth. The wearing away of the base of the tooth should give it a hooked shape which would result in rapid film wear.

The principal objective of the theatre tests, as outlined by the Sub-committee on Projector Sprocket Design, was the determination of the comparative wear of the 0.935-in. and the oversized intermittent sprockets. Fortunately, our former theory in regard to sprocket wear was somewhat in error. In every theatre in which these oversized sprockets have been compared with the 0.935-in. ones, the latter have shown the more wear.

In Figure 6 and 7 are shown the various degrees of wear on each of 4 teeth from a set of sprockets removed after 20 months' operation in the Riviera Theatre in Rochester, N. Y. Figure 6 shows the wear on the 0.943-in sprocket. The wear on this larger-diameter sprocket is predominantly at the base, as the theory suggested, but it is slight and not sharply defined. There is no evidence of a hook. The wear on the corresponding 0.935-in. sprocket is shown in Figure 7. Note that in the case of this sprocket, the film has cut deep grooves into the face of the teeth. The striking thing about these grooves is that they vary in depth and in the distance from the base of each of the 4 teeth.

A similar comparison is given in Figure 8 which shows the various degrees of wear on each of 4 teeth of a set of 3 sprockets removed from the RKO 58th Street Theatre, New York City, after 1552 hours projection time for each sprocket. Again, the wear on the 0.935-in. sprocket is greater than that on the oversized sprockets. This difference in type and extent of wear is more apparent when the sprocket teeth are examined with the aid of a binocular microscope than in the photomicrograph.

Obviously, the analogy of the sprocket and the steel tape to the case of the sprocket and the film is not complete. It is hoped that in the near future there will be more concrete evidence of the nature of the action of film on intermittent sprockets during the pull-down cycle.

The foregoing remarks relate to the difference in the nature of the wear on the sprocket teeth. The increased extent

* As early as 1933, larger-diameter intermittent sprockets were in use in several European projectors. In 1933, intermittent sprockets used on Ernemann projectors in France and Germany measured 0.9452 in. in diameter, and those on the Kalle projectors in England, 0.941 in. in diameter. The Phillips projector, which was described before the Society by T. W. M. Schaffers, is equipped with 0.945-in. diameter intermittent sprockets. When conditions permit, a survey of the results obtained from the use of these larger-diameter sprockets in Europe should be of value.

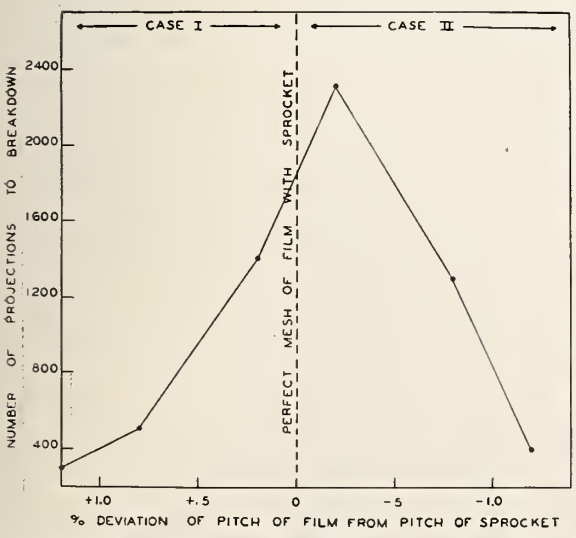


FIGURE 5. ***Relationship between the per cent deviation of the film from the sprocket pitch and the number of projections that produce film breakdown.***

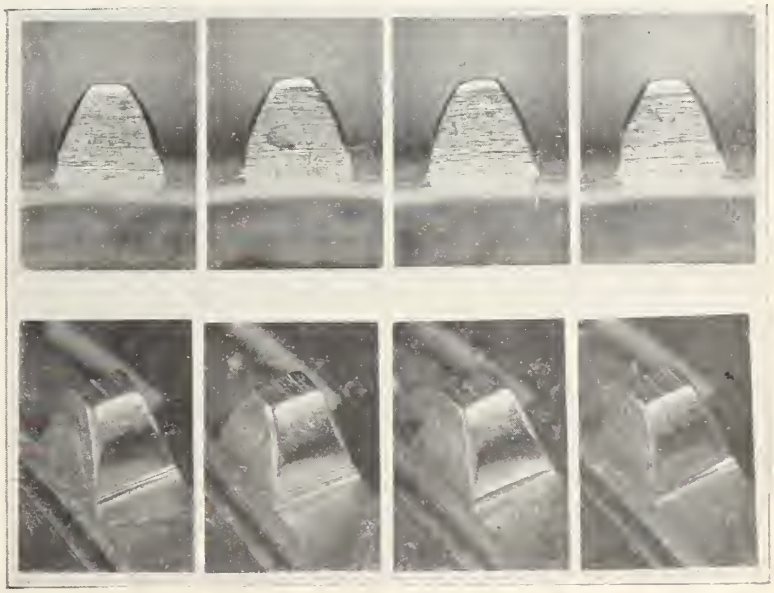


FIGURE 6. ***Wear on 0.943-in. sprocket after 20 months' use in Riviera Theatre, Rochester, New York.***

of wear on the 0.935-in. intermittent sprocket as compared to that on the oversized sprocket is explainable. In the case of the former, the additional force necessary to thrust the film ahead of the rotational speed of the sprocket manifests itself in increased wear of both film and sprocket teeth. When the pitches of film and sprocket are equal, the driving force is spread over 2, or even 3 teeth simultaneously—resulting in decreased wear on both film and sprocket. This condition should hold true even when the 2 pitches are nearly equal, as a result of the local stretching of the film upon impact.

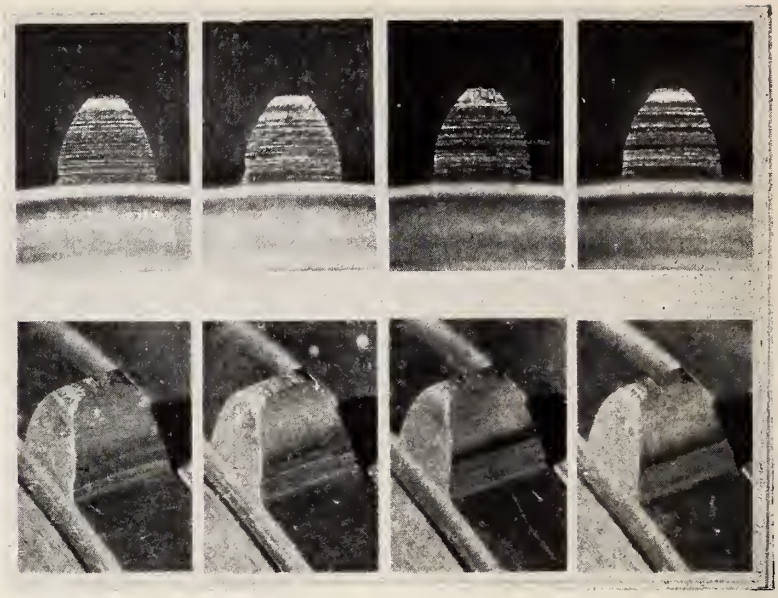


FIGURE 7. *Wear on 0.935-in. sprocket after 20 months' use in Riviera Theatre, Rochester, New York.*

Correct Alignment of Film

It is therefore gratifying that by the use of increased diameter intermittent sprockets substantially increased film life can be achieved with no increase in sprocket wear. Figure 9 is a drawing of the marks made on the standard positive-type perforation by the intermittent sprocket on one passage through a projector. It is impossible to align the film on the intermittent sprocket so that the later will strike the film in the center of each row of perforations. This is because the transverse pitch of the sprocket is less than that of the film.

If the film is centered on the intermittent sprocket on one row of perforations, the sprocket will ride very near the inside corner of the other row of perforations, as in Case II, and wear or rupture will then almost invariably occur at the point nearest the sprocket tooth, or at *A'*.

It is believed that the best alignment with the present intermittent sprocket occurs when the sprocket is centered as nearly as possible on each row of perforations, or so that distances *A* and *A'* are equal, as in case 1. Even under this condition, the preponderance of wear occurs in the corners at *A* and *A'* and occasionally at the outer corners also. Only rarely does it occur directly under the point of impact, in the case of the 0.935-in. intermittent. This is because the perforation is weakest at the points of curvature, the wedging-on action causes a strain throughout this entire area, and rupture occurs at the weakest point.

Correct alignment of the film on the intermittent sprocket in the case of the standard positive-type perforations is illustrated in Figure 10*. Note that the distance from the inside edge of the left-hand perforation to the point of impact of the intermittent-sprocket tooth is nearly 3 divisions of the grid, and that the corresponding distance on the opposite row of perforations is again nearly 3 divisions. In other words, distances *A* and *A'* are equal. Perfect alignment can rarely be obtained by predetermination from measurements made on the projector, *i. e.*, by mechanical setup. It can best be accomplished by allowing the intermittent sprocket to mark the perforations, and then, by projection of these markings on graph paper, making the necessary adjustment in alignment.

Although there are no data on the subject available at this time, experiments

(*Continued on page* 25)

* The film was allowed to make one passage through the projector, thereby leaving the mark of the intermittent on the perforation. The film was then placed in a Recordak Viewer, a projection made of the marked perforations onto graph paper, and the superimposed image of the perforation on the graph paper photographed. In practice, millimeter paper is used for more precise alignment. In these photographs, ½-cm grids were used to facilitate reproduction.

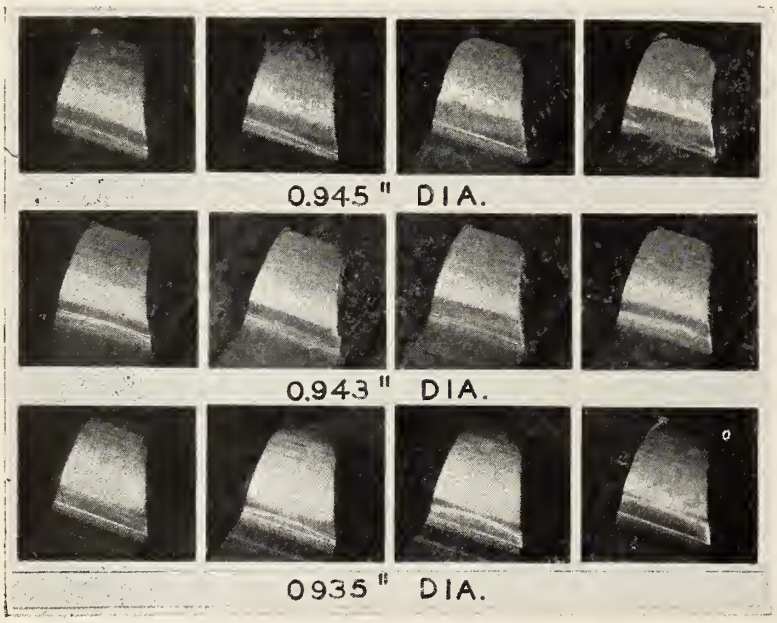


FIGURE 8. *Comparative wear on 3 sprockets used in RKO 58th Street Theatre, New York, for 1552 hr.*

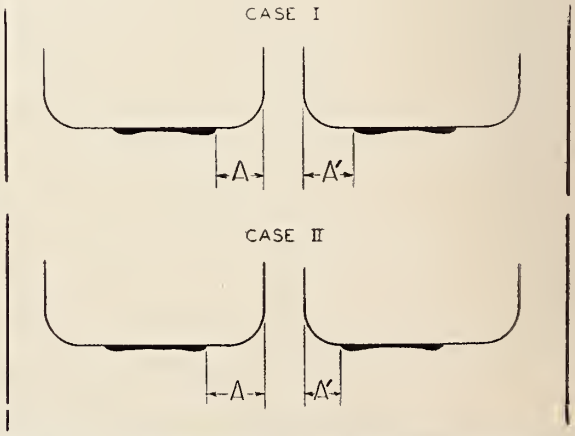


FIGURE 9. *Impact marks of an intermittent-sprocket tooth on a film perforation. Case I—Correct Alignment; Case II—Incorrect Alignment.*



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Step-by-Step Analysis of An RCA 16-mm Amplifier

By *AARON NADELL*

Continuing I. P.'s presentation of 16-mm projection systems, there is here presented a complete step-by-step analysis of the amplifier used with the RCA PG 200-A projector. A fully-illustrated description of the construction, operation and maintenance of that projector appeared in a recent issue.

CIRCUIT arrangements not commonly used in the theatre appear in the apparatus diagrammed in Figure 1. The projectionist can therein make the acquaintance of an oscillator circuit, something more commonly associated with radio than with talking pictures; of a ground bus that is negative to some circuits and positive to others; and of a resistor which varies in resistance inversely to the voltage applied, and therefore, can serve as a voltage regulator.

Power input to Figure 1 is plugged to a receptacle, seen at the bottom left of the drawing. From the top of the receptacle trace upward and right through the amplifier switch, through the fuse, down through the primary of the power transformer, and back to the lower side of the receptacle.

The lower of the three secondaries of this transformer supplies current to the heaters of all tubes except the rectifier tube. A pilot light is connected in parallel to this line. The upper secondary supplies the filament of the rectifier; the middle secondary supplies the rectifier plates.

As in all conventional full-wave rectifiers, only one plate operates at any given moment—that one which happens just then to be positive. The other plate, being negative, attracts no electrons from the filament, and is momentarily an open switch. The negative terminal of the rectifier circuit is, therefore, (as in all such rectifiers) the center tap of the plate secondary of the power transformer. From this center tap trace right and straight down to the heavy line which represents the chassis of the amplifier, or "ground." Follow this heavy line right, up, and all the way left and the ground symbol will be seen near its extreme left-hand end.

Negative Terminal

Ground, or chassis, therefore, is negative with respect to all the d.c. drawn from the rectifier, since it connects solidly to the most negative point in the working circuits of that rectifier. All of this is completely conventional and is duplicated in any number of sound amplifiers. It will be seen later, however, that chassis or ground is the positive terminal of another d.c. circuit in which the d.c. is obtained from a different source.

Chassis or ground in Figure 1, therefore, is a little like the "neutral" in a 3-wire 110-220-volt Edison d.c. power circuit—negative toward one leg, positive toward the other. The rectifier circuit just examined is one of the two d.c. "generators" or sources of voltage; the other will be traced further along.

The negative terminal of the d.c. drawn from the rectifier being the center tap of the power transformer, the positive terminal will be (in the usual way) the filament of the tube. The negative terminal has been traced to ground. From the lower side of the filament trace right, up and right, thence down through a 40-microfarad condenser which is bridged directly across from positive to ground and serves as a large-size filter condenser.

All plate voltage supplies (except the anode voltage of the PEC) are drawn

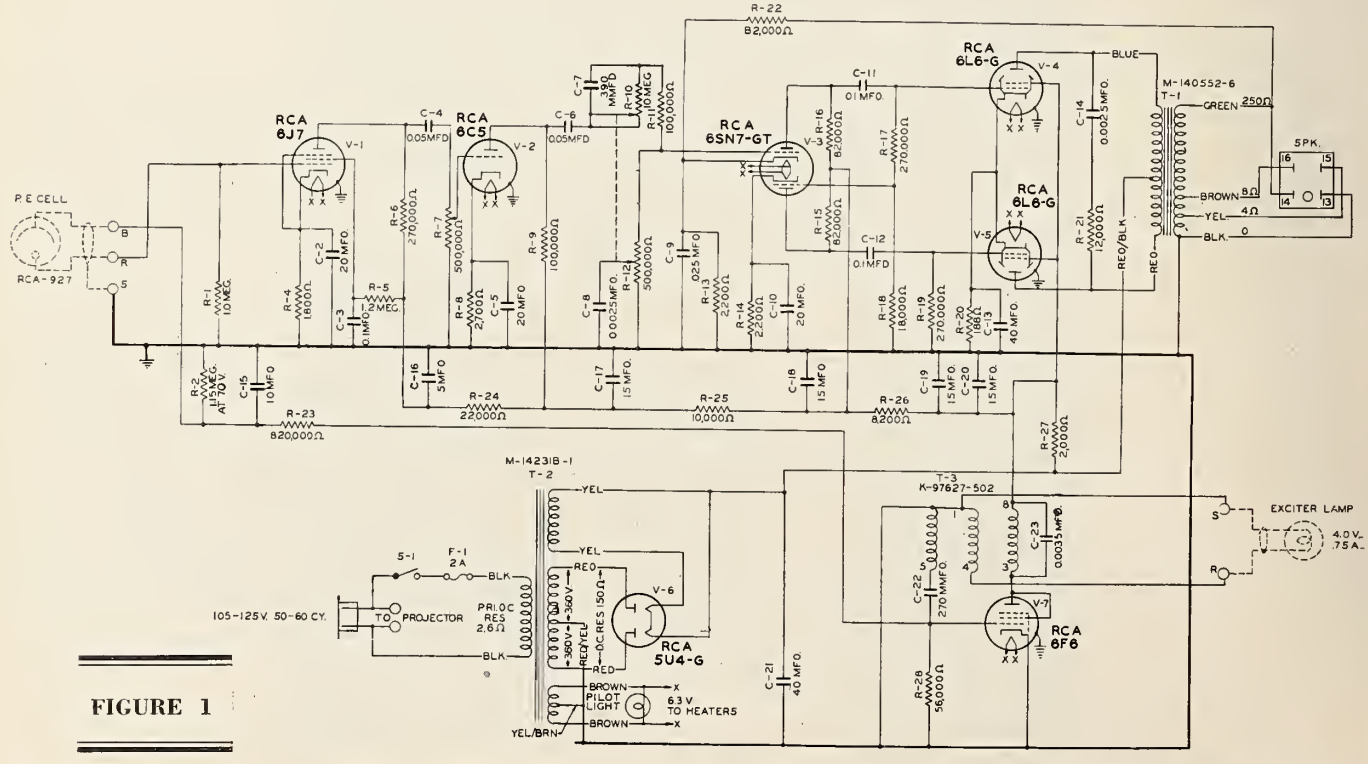


FIGURE 1

from the rectifier circuit in this schematic. therefore the chassis. which is the negative terminal of the rectifier, will be the negative terminal of the plate voltage applied to every tube. Plate voltage is applied to a tube positive to plate, negative to cathode. The cathode of every tube in the schematic returns to chassis, either directly or through a resistor which serves to provide grid bias.

The positive line can be traced to the plate of each tube as follows:

From the filament of the rectifier up, right, up, right as far as possible, up, to the center tap of the primary of the output transformer, then through the two halves of that primary to the plates of V-4 and V-5.

From the filament of the rectifier up, right, up, right to the first junction point, up through R-27, left, down through coil 8-3 to the plate of V-7.

From the filament of the rectifier as before, up through R-27, left, down to the first junction point, left through R-26, up at the next junction point, left, and thence up and down through R-16 and R-15 to the plates of V-3.

From the filament of the rectifier as before, up through R-27 and left through R-26, thence further left through R-25, up at the second junction point and left to the plate of V-2.

Again beginning at the rectifier filament follow through R-27, R-26 and R-25 as before, continue left through R-24 and then up and left to the plate of V-1.

The line that runs across the drawing, beginning at the upper end of R-27, and that has R-26, R-25 and R-24 in series, may be regarded as the positive bus bar of the rectifier output circuit, and since chassis is the negative bus, the row of condensers that bridge across from positive to negative along the length of this line function as filter condensers. Beginning at the left of R-24 they are C-16, and continuing left to right C-17, C-18, C-19 and C-20. They also serve, in association with R-24, R-25 and R-26, as decoupling condensers, by-passing the speech a.c. of each tube back to its own cathode, and thereby preventing unwanted feedback from one tube to another through the common wiring of the plate supply source. Where such undesirable feedback exists an amplifier can convert itself into an a.c. generator, producing one loud frequency and no other sound whatever.

Generator Circuit

Inverse feedback, as often traced in the pages of I.P., consists essentially of wiring the output of an amplifier tube back to the input, or to the input of some preceeding tube, *in inverse phase*. That arrangement, which also exists in Figure 1 and will be traced hereafter, improves sound quality. But if the output of any amplifying system is brought back to an input circuit *in phase* with the input, the system may become a generator, producing a.c. of some frequency determined by its inherent characteristics.

In public address work, if the sound of the loudspeaker gets back to the microphone in sufficient volume the system will emit nothing but a prolonged howl. A telephone will behave the same way if the receiver is put close to the mouthpiece.

If the system contains amplification, if the loss in the course of feedback is less than the gain in amplification, and if the feedback is in phase with the source, the system becomes an a.c. generator.

V-7, in the lower right-hand corner of Figure 1, is a tube having cathode, grid and plate, and, therefore, capable of amplification; the plate or output circuit is very efficiently coupled back to the grid or input circuit, as will be explained in a moment, and the feedback is in phase, not in reverse phase, that is, not 180 degrees out of phase, as with inverse feedback. Therefore, V-7 and its associated circuits will generate a.c.—V-7 is a generator or oscillator tube. The frequency at which it will oscillate—the frequency of the a.c. it generates—depends on the inductance and capacitance and resistance of its associated circuit elements. In other words, those elements act like the inductance and capacitance of a band-pass filter, they will pass some one frequency better than any others. That will be the frequency V-7 generates.

The feedback in this case is inductive. Coil 8-3 is in series with the plate or output circuit of the tube: coil 1-5 is in series (through C-22) with the grid or input circuit; the two coils are in inductive relationship to each other like the primary and secondary of a transformer and they are so poled that the feedback from output to input will be in phase, not 180 degrees out of phase. Under those circumstances the tube must oscillate—generate a.c.

The frequency generated partly depends on the inductance of the coils, partly on the capacitance of their associated condensers, C-22 and C-23. Those constants have been so chosen that the tube will produce a power at a frequency of between 28,000 and 32,000 cycles per second.



Carl M. Weber, president of the Weber Machine Corporation of Rochester, N. Y., received the Army-Navy E Award last month for wartime services rendered by his company. Pictured above are Lt. Col. Ronald C. Hands of the Army and Lt. Com. John T. Casey of the Navy presenting the award to Mr. Weber.

Exciter Lamp Supply

Projectionists are familiar with three ways of supplying filament current to an exciter lamp. In the early days of sound, storage batteries were used. Current theatre practice favors suitably filtered rectifiers. In small theatre systems, and in some portable systems, the exciter lamp is lit by line a.c. stepped down through a transformer, but this tends to produce a hum of line frequency in the sound owing to the alternate heating and cooling of the filament with each cycle of current. Systems using line a.c. on their exciters cannot reproduce the lower sound frequencies without also introducing line hum: therefore, the sound system is designed not to pass these frequencies. This arrangement involves some sacrifice of sound quality.

A fourth method of providing exciter lamp current is shown in Figure 1. Here a.c. of approximately 28,000 cycles is used. Probably the filament can't heat and cool that rapidly anyhow, but if it did, no human ear would hear it. Human ears don't hear anything higher than 16,000 or 18,000 cycles.

However, the a.c. output of oscillator tube V-7 is not suitable for the exciter lamp—the voltage is too high and the current too small. Therefore, this output is passed through a step-down transformer which reduces the voltage and proportionately increases the current. The primary of that step-down transformer is the coil in series with the plate of the tube, coil 8-3. The secondary is coil 1-4. The upper and lower ends of coil 1-4 are connected (trace right) with the terminal strip through which the exciter lamp is supplied. The current thus provided for the lamp is 4 volts, $^3/_4$ ampere, 28,000 cycle a.c.

Normally a photocell will be provided with its bias voltage from the plate supply circuits of its associated amplifier. This bias, of course, is applied positive to anode, negative to cathode. But the positive anode of the cell must connect with the negative grid of the first amplifier

tube. To avoid putting a positive charge on the grid of the tube, the cell is usually coupled to the tube through a condenser.

PEC Supply

In Figure 1 advantage is taken of the fact that an oscillator tube connected in the way used for V-7 will generate (in addition to a.c.) a d.c. voltage across its grid and cathode, negative to grid.

Since the tube is an oscillator, generating a.c., it follows that a.c. must appear on both its plate and grid. During part of each a.c. cycle, therefore, the grid will go positive and attract electrons. The negative charge thus created on the grid can only leak off to ground through C-22 or R-28; and the values of those parts (their "time-constant") can be so chosen that the electrons can't leak off quite as fast as they are attracted, thus leaving a permanent negative charge on the grid. (Projectionists familiar with radio circuits will note the similarity to the negative grid bias that appears, in very much the same way, in a grid-leak detector circuit.)

Examination of the circuits of V-7 will show that no external grid bias of any kind at all is applied to that tube; nevertheless a negative bias forms on the grid, in virtue of the tube's action, as just explained. Thus there are both a.c. and d.c. components on the grid of this tube. The a.c., being 28,000 cycles, can do no harm in an audio circuit, since it can't be heard. Therefore the d.c. component on the grid of V-7 can safely be tapped off and applied to the cathode of the PEC.

From the grid of V-7 trace left as far as possible, up, left as far as possible (through R-23), past R-2, up and left to the cathode of the cell.

But the grid of R-7, as just explained, is negative with respect to the cathode of that tube; and that cathode is wired solidly to chassis. Therefore, the grid of V-7 is negative with respect to ground; and the cathode of the PEC is thus negative with respect to ground. If the anode of the PEC were grounded, it would be positive with respect to cathode. Thus in this circuit the anode can be made positive by grounding it (positive with respect to its own cathode), and when grounded it can safely be connected to the grid of the first amplifying tube without any intermediate coupling condenser or transformer.

Actually, in Figure 1, the anode is not grounded; it is wired directly to the grid of V-1. With no signal in the photocell (soundtrack dark) the anode is actually at ground potential. When signal is generated in the PEC, anode potential will vary, with respect to ground, by approximately one volt. Cathode is normally 75 volts negative with respect to ground.

Again beginning at the grid of V-7, trace left, up and left to R-23. Just left of R-23 a filter and decoupling condenser, C-15, is bridged across to ground; and left of this R-2 is bridged across to ground. R-2 has a resistance of 1.15 megohms when 70 volts is connected across it, but its resistance varies if the voltage increases or decreases. Ordinary resistors of course do not change that way; R-2 is made of General Electric "Thyrite," a proprietory composition approximating a variety of aluminum silicate porcelain. Because of the unusual property of this material, R-2 serves as a voltage regulator in association with R-23.

Should the negative bias on the grid of V-7 increase for any reason, the resistance of R-2 will decline. Thereupon the current through R-2 will rise. In any case, increased voltage would produce increased current flow by Ohm's Law, but in this case the resistance also falls off, producing a still greater current flow than would normally follow. The current must complete its path through R-23, which is in series; and the voltage drop across R-23 increases in proportion to the increase in current.

Since R-23 and R-2 are in series, increase in the voltage drop across one effects a decline in the voltage drop across the other. Thus the original increase in the bias of V-7 is counteracted so far as the voltage drop across R-2 is concerned; and the voltage across R-2 is the same as the voltage across the PEC, the cell and R-2 being in parallel.

If the bias on the grid of V-7 declines, the reverse action takes place. The peculiar properties of R-2, in association with the ordinary resistor R-23, therefore act as a voltage regulator to keep the bias across the PEC constant.

The foregoing concludes consideration of unusual features in this amplifier. The circuits remaining to be traced are quite conventional, and such as the reader has often encountered in these pages.

Screen Grid Supplies

From the filament of the rectifier tube, V-6, trace as before up, right, up, right, up through R-27, and straight up to the screen grids of V-4 and V-5.

In V-7, the oscillator tube at the lower right of the drawing, the screen grid is directly connected to the plate. In V-1, in the upper left of the drawing, trace from the screen grid right, down, and right through R-5 to the plate supply of the same tube.

With the exception of V-1 and V-2 there are no screen grids in the other tubes.

In every case, a source of d.c. is connected across screen grid and cathode, positive to screen grid. In every case the cathode of the tube returns to negative by way of the chassis or ground. In the case of V-7 this return is direct; in V-1 it is through the bias resistor R-4 and condenser C-2; and in the case of V-4 and V-5 through the bias resistor R-20 and condenser C-13.

Suppressor grids are found in V-1 and V-7. In each case they receive their negative bias by direct connection to cathode. There are no suppressor grids in V-4 and V-5, of course, but a somewhat similar overall effect is indirectly produced by the vanes in those beam power tubes, which vanes are internally joined to cathode.

Control Grid Bias

In V-1, plate current through the tube completes its return from cathode to the negative line through resistor R-4. Cathode is, therefore, connected to the positive side of that resistor, while the control grid connects (through R-1) to its negative side. Control grid is negative with respect to cathode by the extent of the voltage drop through R-4.

A similar function is performed by R-8

(*Continued on page* 26)

COLEMAN AND BATSEL APPOINTED TO NEW RCA POSTS

The appointments of J. B. Coleman as assistant director of Engineering for the RCA Victor Division and M. C. Batsel as chief enginer of engineering products were announced by D. F. Schmit, director of engineering for the RCA Victor Division.

Mr. Coleman, who joined RCA in 1930, will make his headquarters at the company's home office in Camden, N. J. Mr. Batsel is widely known in the radio and motion picture industry, and became associated with RCA in 1929.

REVOKE FILM CONTROLS

The War Production Board has revoked the two orders controlling the film industry, the agency announces. Ending these controls, it was pointed out, means that much more film will be available. Army and Navy officials have advised WPB that the services have cancelled all outstanding service orders on the books of film producers, and will review their current needs in the immediate future, after which the services will reinstate certain necessary orders for film. It is expected, however, that with one exception the military reorders will not amount to more than half the orders which had been placed for the fourth quarter.

Third quarter production will approximate 145,000,000 square feet of all kinds of film, it was said. Sixty per cent of this will go directly to the services, and a good deal more indirectly, as in the reels of Hollywood pictures which are sent to Army and Navy outfits all over the world, but eventually revert to Hollywood. Fourth quarter production is expected to be about 160,000,000 square feet, with the direct and indirect military consumption to fall steadily. Supply and demand should approach a balance during the last quarter. The orders revoked were L-178 and L-233.



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Advances in Industry Featured at SMPE Conference

IMPORTANT advances in sound and projection were discussed by industry leaders at the 58th semi-annual technical conference of the Society of Motion Picture Engineers which was held at the Hotel Pennsylvania, New York, October 15-17.

President Donald E. Hyndman extended the welcome to members at the opening session on October 15. A record attendance was noted at all the technical sessions which were highlighted by many interesting speakers. At the opening session a warning was sounded by E. W. Schultz, of the Army Medical Center, that this country may face a "Pearl Harbor" in its war veterans rehabilitation program unless immediate steps are taken to make available more high-quality 16-mm education and documentary motion pictures.

The evening session was highlighted by a talk on color photography given by Lt. Col. R. H. Ranger, U. S. Army Signal Corps, who recently completed a survey of the I. G. Farben Agfa Plant at Wolfen, Germany, on behalf of the Technical Industrial Intelligence Committee of the Department of Commerce. Col. Ranger stressed the importance of this newly discovered Farben Agfa color process and it was the opinion of the audience that this process is a significant advance in color photography. One of the greatest difficulties in color photography, the spreading of the color from the dye, has been overcome by the new technique in such a way as to insure greater photographic sharpness and detail.

Col. Ranger's talk was sponsored by the U. S. Department of Commerce with Nathan D. Golden, chief of the motion picture division, presiding.

The new "dual" projector was the subject of a paper read at one of the sessions by Thomas C. Hoad of the General Theatre Supply Co., Toronto, Canada. This new projector is said to remove eyestrain and nervous fatigue in viewing pictures, provides more definition, sharper focus and brighter screen illumination.

Mr. Hoad explained the action of this projector which eliminates the necessity for using two identical films for each showing. "A positive film," he stated, "was made from the regulation negative in a dual printing process. All the odd number frames—1, 3, 5, etc.,—were printed first, then the positive was shifted ahead on the negative the space of several frames and the even number frames —2, 4, 6, etc.,—were printed between the odd number frames. The odd number frames were printed black on one side of the sprocket holes opposite the sound track, the even number being white. This identification was made for splicing purposes and in case of film breakage.

"A projector mechanism was built with two film trap members, two lens mounts, and two intermittent movements, one above the other. Each intermittent movemen pulls down two frames at a time, with all even number frames projected through the upper aperture, while odd number frames are projected through the lower aperature. In this way action on the screen is continuous."

At the semi-annual dinner dance, held Tuesday evening, October 16, in the Georgian Room of the hotel, President Hyndman presented the 1945 Journal Award to Herbert E. Goldberg, Charles J. Kunz, and Charles E. Ives, all of Kodak Research Laboratories, for their jointly prepared paper "Improvement in Illumination Efficiency of Motion Picture Printers," which was published in the May 1944 isue of the Journal.

Mr. Hyndman also announced the election of the following ten members to fellowships in the SMPE: George L. Carrington, president of Altec Service Corp.; Charles E. Ives, Kodak Research Labs.; Charles F. Horstman, RKO; Charles L. Lootens, Paramount Pictures; Jack A. Norling, Loucks and Norling Studios; Lt. Col. John O. Aalberg, U. S. Army Signal Corps (on leave as sound director for RKO); Herbert Barnett, International Projector Corp.; John G. Bradley, director of motion picture project, Library of Congress; Maj. Lloyd T. Goldsmith, director of Pictorial Engineering and Research Laboratory Division, U. S. Signal Corps Photographic Center; and G. T. Lorance, International Projector Corp.

Abstracts of some of the papers read at this conference and which may be of particular interest to the readers of I. P. follow:

WARTIME RECORD AND POSTWAR FUTURE OF PROJECTION AND SOUND EQUIPMENT

Allen G. Smith
National Theatre Supply Co., New York
Formerly Chief, Theatre Equipment Section, WPB

This paper is a case history of the manufacture and distribution of 35-mm motion picture projection and sound equipment under wartime restrictions, as imposed by War Production Board regulations. It tells about the difficulties and problems which were encountered and overcome, so that the Armed Forces might get all of the equipment they needed, with a limited quantity for our civilian theatres. The paper also discusses the reasons why our manufacturers cannot now produce as much new equipment as will be needed for replacements, and makes recommendations for future planning.

PROJECTION EQUIPMENT FOR SCREEN ROOMS

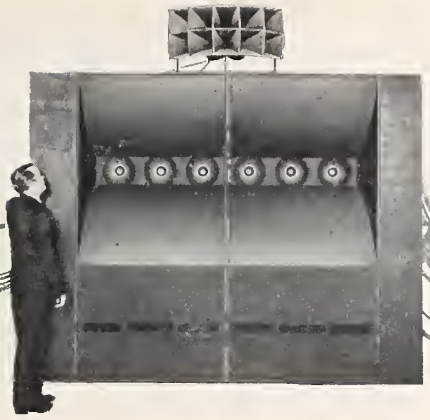
H. J. Benham
RCA Victor Division

In many respects, more is required of the projection equipment used in the screening rooms of motion picture studios and film laboratories than is required of such equipment when used in other tyyes of screening rooms or in regular theatres. It is important that the projection equipment used in studio

(*Continued on page* 30)



Donald E. Hyndman (right), president of the Society of Motion Picture Engineers, preseuts the 1945 SMPE Journal Award to the co-authors of the paper "Improvement in Illumination Efficiency of Motion Picture Printers," which was adjudged the best paper published in the Society's Journal during 1944. Winners of the coveted Journal Award are, left to right, Herbert E. Goldberg, Charles J. Kunz, aud Charles E. Ives, all of the Kodak Research Laboratories, Rochester, N. Y.



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IN THE SPOTLIGHT



By *HARRY SHERMAN*

NOW THAT the Surplus War Property Board has publicly announced that all projection equipment used by the Army, Navy, and other Government agencies during the war are no longer needed and will be made available at very lost cost to schools, churches and non-taxable organizations unable to afford them at retail prices, it would not be amiss for I. A. local unions to bid for some of the surplus 16-mm projectors. We believe that one of these surplus 16-mm projectors should be made available to every local, to instruct the membership in the care and operation of such equipment.

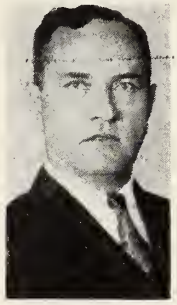
We cannot duck the issue—the 16-mm projection field is constantly growing and the demand for men qualified to handle these machines is steadily increasing. We regret to state that the percentage of our men capable of handling this equipment is very small. Many progressive I. A. locals have recognized this fact and formed classes on 16-mm instruction for their members, a number of whom are gainfully employed in the showing of 16-mm pictures for various industrial firms. But there still are many local unions asleep at the switch, as it were, and it is to them that this item is directed. The purchase of a war surplus 16-mm projector at a very low cost, is not beyond the reach of even the smallest union with a very limited bank balance. The benefits derived from this expenditure would more than compensate each man for his share of the cost.

● After a final 15-hour "do or die" session with the exhibitors, the Wage Scale Committee for New York City Local No. 306, with the able assistance of I. A. President Dick Walsh, successfully concluded negotiations for new contracts. New two-year contracts calling for a flat 15% increase have been signed with the following circuits: RKO, Loew's, Translux, Randforce, Skouras and the Broadway de-luxe houses, as well as with the companies having studio projection rooms. A compromise was reached on the question of requests, with the union retaining the right to 50% of the requests on circuit houses, except the theatres on Broadway.

Working with President Walsh were Herman Gelber, Local 306 president; Harry Storin, vice-president; Nathaniel Doragoff, secretary; Jimmy Ambrosio, treasurer; Charles Beckman, financial secretary; Ben Scher and Morris Kravitz, business agents; Ben Morel, Harry Garfman, Hyman Boritz, executive board members, and Harry Mackler, Charles Kielhurn and Burt Popkin.

● That there is strength in unity has been proven by certain of our West Coast local unions. Under the leadership of Charles Vencill, secretary, Wallace Crowley, president, and George Schaeffer, business agent of Local No. 150, Los Angeles, all I. A. local unions in the southern part of California combined and worked together during the negotiations for new contracts. This swell teamwork resulted in new contracts for all the locals calling for increases up to 15% and two weeks vacations with pay.

● Due largely to the efforts of Bill Covert, I. A. vice-president and business agent for Local No. 173, Toronto, Canada, eight of the nine Canadian provinces have been cleared of all dual unions and are now 100% unionized. A sore spot in the nature of a rump union, calling itself the All Canadian Congress of Canada, operating in the vicinity of Local No. 300, of Saskatoon, Saskatchewan, was recently cleared up and we understand that Bill has undertaken to tackle the dual union problem in Montreal. We expect to hear shortly that the union in question has taken the same road as the others—to oblivion.



Wm. P. Covert

● About 500 friends and associates of Joe Monaco, for over 25 years business agent of Local No. 366, Westchester County, attended a dinner-dance given in his honor last month at the Taft Hotel, in New York City. Every I. A. local in the Metropolitan district was well represented at the affair, and it was the unanimous opinion of all that the party was a huge success—a fitting tribute to Monaco's popularity.

Nat Storch, president of Local 366, introduced the toastmaster, Joe Downing of Musicians Local No. 310. Downing's witty and pertinent remarks kept the guests in high good humor. Speakers of the evening were W. P. Raoul, I.A. general-secretary-treasurer; Martin Lacey, president of the Central Labor Union; and the honored guest, Joe Monaco.

Among the invited guests at the party we noticed Tom Shea, the new I. A. assistant president; Jim Brennan and Joe Basson of the general office; Rosenberg and Feinberg of the Musicians Union; Matthew Levy, attorney for the I. A.; Bert Ryde, business agent for Local No. 233, Buffalo; Wm. Bennett, business agent of Local No. 22, Washington, D. C.; H. Paul Shay, business agent of Local No. 289, Elmira, N. Y.; Morrie Seamon and Jimmy Murphy, business agent and secretary, respectively, of the Treasurers and Ticket Sellers Local.

● Neil Bishop, former treasurer of Chicago Local No. 110, has retired from all union activities and is now making his home in Stuart, Fla.

● Harry Blumberg, member of Philadelphia Local No. 307 for over 30 years, took the plunge recently and opened a supply business in partnership with his brother Ben. The Blumberg brothers are extremely well liked in the industry and their new venture should prove highly successful.

● John Krebs, business agent of Cincinnati Local No. 327, was delighted last month when his son, John, Jr., came home on furlough. Young Krebs is a veteran of the European war and is the proud possessor of the Bronze Star and the Purple Heart.

● Local No. 199, Detroit, Mich., recently concluded negotiations for new contracts granting a $3 weekly increase to all mem-

bers working regular shifts, and a $6 weekly increase to those men working night shifts in the all night houses. After the second year the contract is in force, all wages will be automatically increased an additional one dollar per week. All men are to receive vacations with pay. Roger Kennedy, I. A. vice-president and business agent for Local No. 199, negotiated for the local.

● George H. Seibert, member of Local No. 306, died at the age of 62 from a heart attack suffered in the projection room of the Loew's theatre where he had been employed for the past 17 years. Seibert was president of the Bellmore (L. I.) Board of Education and was interested in many charitable enterprises.

● All attempts of New York City Local No. 306 to put through an amendment to the law covering proper sanitary facilities for projection rooms have thus far ended in failure. Many exhibitors are lavish in their expenditures for plush seats, expensive lobby decorations and glamorous rest rooms for the patrons, but they seem to consider the installation of sanitary facilities for their projectionists an unnecessary expense. In the opinion of many of these exhibitors, projectionists are not human beings but automatons and the laws of nature do not apply to them.



Gene Atkinson

We were interested to read in the trade press that the Independent Theatre Owners Association of New York sponsored an amendment, signed by the mayor, which covers smoking in certain sections of the theatre. Perhaps if this organization could be convinced that the health of the projectionist—the key man in a motion picture theatre—is jeopardized by the lack of proper toilet facilities—it might (we say.might advisedly) be more amenable to the suggestion that something be done about the matter.

In Chicago, however, the story is different. There, when the new contracts were drawn up, Gene Atkinson, business manager of Local No. 110, insisted that provisions be made for safe and sanitary places of employment for his members. We shall list a few of the sanitary conditions covered in all Local 110 contracts:

1. Adequate ventilation and dual exhaust fans

2. Toilet in projection room or adequate toilet facilities on same floor level

3. Running water available on same floor level

4. Projection room to be painted at least once every two (2) years

5. Linoleum on projection room floor

6. A fifteen-minute (15) period every two (2) hours for projectionists where provision 2 above is not complied with

7. Where there are no adequate facilities for washing up, the projectionist shall be allowed fifteen (15) minutes additional time following the completion of his shift for wash-up time.

We think that eventually all projection rooms in Local 110 jurisdiction will be equipped with necessary sanitary facilities. Any way you look at it, it would be much cheaper in the long run for the management to pay a small plumbing bill than to stop the show several times a day to allow the projectionist a 15-minute rest period.

● We received a very sincere and touching letter from one of our readers, Joseph F. Holt, member of Local No. 692, Marlin, Texas, in which he pays tribute to J. W. Southwick, the recently deceased president of Local No. 428, Stockton, Calif. He mentions the spirit of cooperation that has always prevailed between the officers and members of that local, due, he writes, in a great measure to the tact and ability of the late president.

"*As a youngster in the game, which I still am,*" *writes Holt,* "*I received much valuable advice from Brother Southwick (whose son about my age is a member of* 428) *when I worked in his jurisdiction, and likewise received stern reproof when I stepped 'over the line.' Brother Southwick's death leaves me with the thought that here was a pioneer, who, like many others like him, helped make the I. A. the great organization it is today. I am proud to have known him and have profited greatly from his friendship.*

"*Allow me to include here a bit of personal congratulations on the conduct of your columns. Frequently I run across old friends or make new ones with the intimate sketches you include in your material. In addition, your barbed indictments of practices, which we all know to be widespread, probably do more good than you yourself realize. In any case it is good to see a man stand up for what he believes to be right.*"

Thank you, Brother Holt.

● Congratulations to the I. A. officers on their first television contract. A five-year contract between the DuMont television sudios and the I. A. Television Studio Broadcasting Employees Local No. 794 was signed last month, providing for adjusted salaries ranging from $41 to $80 per week for a 40-hour, 5-day week. This contract, retroactive to May of this year, calls for a 5% increase at the end of the first year, an increase of 15% at the end of the second year, and an additional 10% increase at the end of each year thereafter. The men are to be paid time-and-a-half for overtime during their regular working days, and double time for any other period. Employees with the company more than six months are to receive one week's vacation with pay, and those with the company two years or more are to receive two weeks' vacation with pay. In addition they are to have six paid holidays each year. Nice work, we say.

● Because of failing health, Harvey Hill resigned from office as business agent of Dallas Local No. 249, a post he held for six years. His successor, Charles Harcum, is an old-timer in the Alliance, and should prove a very capable official.

● Capt. Merle Chamberlin, member of Hollywood Local No. 165 and formerly chief projectionist at the M-G-M studios in Hollywood, has returned to this country after spending several years in the European theatre of war. Merle is at present stationed at Fort Benning, Ga., awaiting his discharge from the Army, when he plans to return to his former position at M-G-M.

● New contracts calling for increases in salaries, *plus* vacations with pay have been signed by Local No. 444, New Kensington, Penna. Bill (Blackie) Bordonaro, president, F. P. McCoy, secretary, and J. J. McCloskey, business agent, negotiated for the local.

● Projectionists certainly are on the alert for new technical developments in the industry. Again we were reminded of this fact by the large projectionist attendance at the technical sessions of the SMPE semi-annual conference held in New York last month.



W. C. Kunzmann

Among the out-of-town projectionist members of the Society we spotted were Stewart Seifert, member and former secretary of Local No. 203, Easton, Penna.; Nat Golden, member of Cleveland Local No. 160, and chief of the motion picture division of the U. S. Department of Commerce; Victor A. Welman, secretary of Local 160, and brother members Frank DeNol, Henry Liebler and Tom Kulka.

Other out-of-town projectionists were Lewis Townsend, Rochester Local No. 253; Nelson Newburger, Montreal Local No. 262; Maj. G. C. Misener, former president of Ann Arbor, Mich., Local No. 395 and now chief of the sound engineer-

(*Continued on page* 33)

Projectionists' Course on Basic Radio and Television

By *M. BERINSKY, E. E.*
MEMBER OF INSTITUTE OF RADIO ENGINEERS

XVII—RESONANCE

THE preceding article discusses the action of the alternating current series circuit. Capacitance, inductance. and resistance are also connected in parallel in alternating current circuits. Figure 1 shows a parallel circuit consisting of an inductance and a resistance. The vector diagram for a parallel circuit is somewhat different from that of a series circuit. In a series circuit the current is the reference vector because it is common to all parts of the circuit. In a parallel circuit the voltage is common to all parts of the circuit and is drawn along the reference line. This is illustrated in Figure 2.

In the parallel circuit we are concerned chiefly with the currents through the circuit components. The current through the resistor (I_R) is in phase with the line voltage. This current is shown along the voltage line. The current through the coil (I_L) lags the line voltage by 90°. In Figure 2 this current is shown as being behind the line voltage by 90°. The resultant line current (I) is shown as being equal to the vector sum of the resistive and reactive currents; that is, $I = \sqrt{I_R^2 + I_L^2}$. This formula is similar to the one for voltage drops in series circuits.

A series circuit containing inductance, capacitance, and resistance is illustrated in Figure 3a. Figure 3b shows the vector relations between the line voltage and the currents through the resistor, coil, and condenser. The current through the condenser (I_C) is seen to be leading the line voltage by 90°. When the current through the coil is greater than the current through the cendenser, the circuit will behave like one which contains resistance and inductance in parallel, as is indicated in Figure 3c. The current through the condenser is

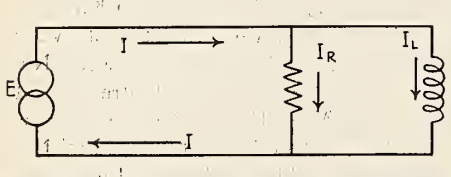


FIGURE 1. ***Parallel circuit containing resistance and inductance.***

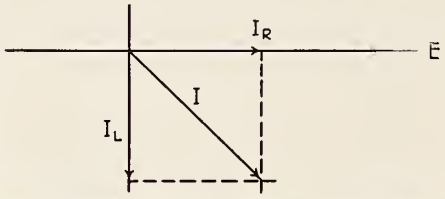


FIGURE 2. ***Vector diagram of parallel circuit containing resistance and inductance.***

subtracted from the current through the coil, and the resultant of these two currents appears like a smaller coil current. From this diagram (Figure 3c) it can be seen that the current through the condenser and the current through the coil is 180° out of phase.

In Figure 3d the current through the condenser is seen to be greater than the current through the coil. Here, again, the two currents are subtracted from each other and the resultant of the two is drawn in the direction of the larger individual current. In Figure 3c the line current is shown to be lagging the line voltage by an angle. θ. This is due to the fact that the coil current is greater than the current through the condenser.

The line current in Figure 3d leads the line voltage because the current through the condenser is larger than the current through the coil. In Figures 3c and 3d the line current is equal to the vector sum of the current through the resistor and the difference of the reactive currents The total line current taken from these figures is shown in the following mathematical formula: $I = \sqrt{I_R^2 + (I_C - I_L)^2}$.

Solution of Parallel Circuits

Because of the extended use of the multiple system of transmission and distribution in electrical work and complicated vacuum tube circuits in radio work, parallel circuits are more common in practice than series circuits. The solution of problems with two or more loads in parallel involves the finding of the current in each branch of the circuit and the combining of these currents vectorially to give the total current. The following example illustrates this point.

A resistance of 10 ohms, an inductive reactance of 8 ohms, and a capacitive reactance of 15 ohms are all connected in parallel across 120-volt, 60-cycle mains. The circuit is the same as shown in Figure 3a. Determine (a) the total current; (b) the circuit power factor; (c) the true power, and (d) the total circuit impedance.

The currents taken by the resistance, inductive reactance, and capacitive reactance are now shown.

$I_R = 120/10 = 12$ amp. in phase with E.

$I_L = 120/8 = 15$ amp. lagging E by 90°.

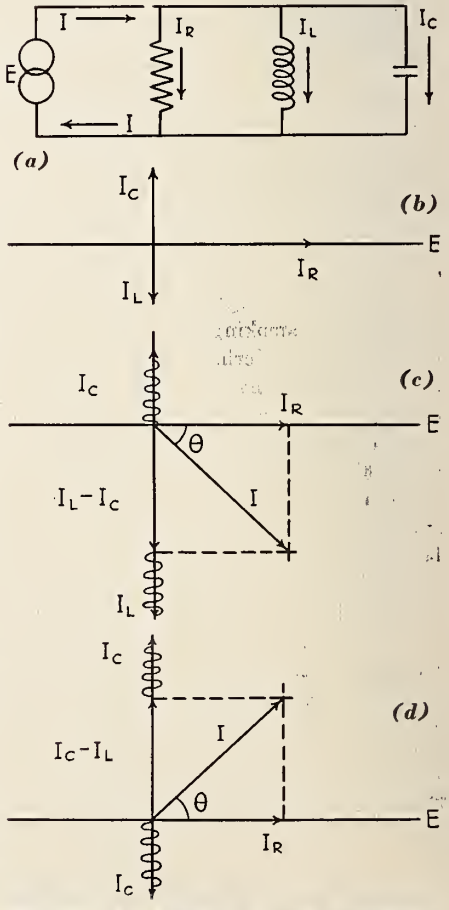


FIGURE 3. ***Parallel circuit containing resistance, inductance, and capacitance; also vector diagrams.***

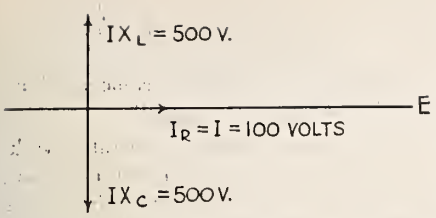


FIGURE 4. ***Vector diagram of a series resonant circuit.***

$I_C = 120 \div 15 = 8$ amp. leading E by 90°.

In this example the current through the coil is greater than the current through the condenser. A vector diagram of this circuit would resemble that of Figure 3c. The voltage is the same for all three branches of the circuit and is laid off as a horizontal vector. The resistance current is in phase with the voltage E. The inductive current lags the voltage by 90°, and the capacitive current leads the voltage by 90°. As the inductive current and capacitive current are in exact opposition, they subtract arithmetically from each other, giving 7 amp. lagging by 90°. The resultant current, I, is the vector sum of the 7 amp. and the 12 amp. currents.

(a) $I = \sqrt{12^2 + 7^2} = \sqrt{144 + 49} = \sqrt{193} = 13.9$ amp. lagging (*total current*).

(b) The cosine of the angle θ between the voltage and the current is $\cos \theta = \frac{I_R}{I} = \frac{12}{13.9} = 0.864$ (*power factor*).

(c) $E \times I_R = 120 \times 12 = 1440$ watts (*true power*). also $E \times I \times \cos \theta = 120 \times 13.9 \times 0.864 = 1440$ watts (*true factor*).

(d) $Z = \frac{E}{I} = \frac{120}{13.9} = 8.63$ ohms (*total circuit impedance*).

Series Resonance

The general expression for the current in a series circuit is shown in the following equation: $I = \frac{E}{\sqrt{R^2 + (X_L - X_C)^2}}$. If the line voltage and the circuit resistance is fixed the current is a maximum when the quantity in the parentheses under the square root sign is equal to zero. That is, in the above equation the current is a maximum when $(X_L - X_C) = 0$. The equation for maximum current then becomes $I = \frac{E}{\sqrt{R^2 + (0)}} = \frac{E}{R}$, its Ohm's Law value. Under these conditions X_L and X_C are equal. Substituting the expressions for X_L and X_C we obtain $2 \pi f l = \frac{I}{2 \pi f c}$.

The current is the same in all parts of a series circuit. When the inductive reactance and the capacitive reactance is equal, the voltage drop across the inductance (IX_L) and the voltage drop across the capacitance (IX_C) will be equal. As these two voltages are in exact opposition, they balance each other so that the I_R drop across the resistor is equal to the line voltage. This is illustrated in Figure 4, which shows that these voltage drops are equal to each other and that each voltage is greater than the source voltage. Such a condition would be impossible in a direct current circuit because the voltage drop across any part of a d.c. circuit can not be greater than the line voltage.

Figure 4 is a vector diagram for a series circuit consisting of resistance, inductance, and capacitance. The condition illustrated is known as series resonance. The frequency at which resonance occurs may be obtained by setting $2 \pi f l$ equal to $\frac{I}{2 \pi f c}$ and solving the equation for f. The new equation will then be $f = \frac{I}{2 \pi \sqrt{L C}}$. Where f is the frequency at which resonance occurs in cycles per second, L is the inductance in the circuit in henrys, and C is the capacitance in farads.

The frequency at which resonance occurs is sometimes called the natural frequency of the circuit, because it is the frequency at which the current in the circuit will oscillate—that is, provided no external frequency is impressed on the circuit and the resistance in the circuit is not too great.

Let us try an example in series resonance. A circuit has a resistance of 20 ohms, and inductance of 0.3 henry, and a capacitance of 20 mfd. Find (a) the frequency at which resonance occurs; (b) the line voltage if the line current is 10 amps.; (c) the voltage across the inductance; (d) the voltage across the capacitance, and (e) the power consumed by the circuit.

(a) $f = \frac{I}{2 \times \pi \sqrt{0.3 \times 0.00002}} =$

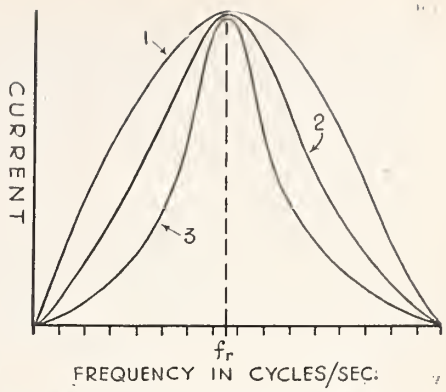


FIGURE 5. ***Resonance curves of a series resonant circuit.***

65 cycles (*frequency at which resonance occurs*).

(b) $E = I \times R = 10 \times 20 = 200$ volts (*line voltage with line current at 10 amp.*).

(c) $E_L = I \times 2\pi fl = 6.28 \times 65 \times 0.3 \times 10 = 1224$ volts (*voltage across inductance*).

(d) $E_C = I \times \frac{L}{2 \pi f C} = \frac{10}{6.28 \times 65 \times 0.00002} =$ 1224 volts (*voltage across capacitance*).

(e) $P = E \times I = 200 \times 10 = 2000$ watts (*power consumed by circuit*).

From the results obtained it can be seen that the voltage drops across the coil and condenser are greater than the line voltage by more than six times. Use of such a circuit is made in radio apparatus. The signal that reaches our receiver from a broadcasting station is very weak. It is boosted by means of a series resonant circuit before being applied to a vacuum tube for further amplification. In a crystal receiver the only amplification of the signal was by means of the resonant circuit, since such a receiver did not contain vacuum tubes.

Combinations for Resonance

We learn from the formula for series resonance that the resonance can occur for many possible combinations of L and C, at a particular frequency, provided that the product of L and C remain constant. For example, a 5-henry coil in series with a 2-mfd. condenser will produce resonance at the same frequency as a 1-henry coil in series with a 10-mfd. condenser because the product of L and C is the same in either case.

The frequency at which resonance occurs is not the only consideration in such a circuit. The manner in which the current alters as the frequency changes is of equal importance and this depends on the relation of the inductance to the capacitance. This is illustrated in Figure 5. Curve 1 was obtained with a large capacitance and a small inductance; curve 2 with a medium sized capacitance and a

OCTOBER QUESTIONS AND CORRECT ANSWERS

1. (Q). A series circuit consisting of 10 ohms resistance, 30 ohms inductive reactance, and 20 ohms capacitive reactance is connected across 220 volt, 60 cycle mains. Solve the problem for (1) the impedance, (2) current, (3) voltage across each part of the circuit, (4) power taken by the circuit, and (5) power factor and power-factor angle of the circuit.

(1) 14.14 ohms; (2) 15.56 amp.; (3) E_R = 155.6 volts, E_L = 467 volts, E_C = 311 volts; (4) 2.42 KW; (5) power factor = 0.707, p.f. angle = 45°.

medium sized inductance, and curve 3 with a small capacitance and a large inductance. The current in either case reaches a maximum value when approaching resonance, and decreases as the frequency is shifted to a higher and a lower value than resonance.

The dotted line in Figure 5 indicates the resonant frequency. Curve 1 is seen to be rather broad. As the inductance is increased and the capacitance is decreased the resonance curve becomes narrower (sharper). You will note that curve 3 is very sharp.

When we change a station on our radio receivers we are, in reality, changing the resonant frequency of a series resonant circuit. When the circuit is tuned to the resonant frequency of a particular broadcast station that station is heard, while all other stations seem to disappear. These stations do not really disappear—many stations reach our antenna but the resonant circuit has the property of amplifying the station to which it is resonant while rejecting all others.

It is desirable that a radio receiver have a reasonable amount of sharp tuning. Such a receiver has the propeprty of being able to separate stations that are close to each other on the receiver dial. A receiver that has a broad tuning curve can not separate stations that are closely spaced on the dial—and very often two stations are heard at the same time. This is especially noticeable in the evening when distant reception is good.

A receiver that tunes sharply is said to have good selectivity. When tuning our radios what we really are doing is turning a variable condenser which is part of a series resonant circuit. The coil in the circuit is fixed. As we change the capacitance of the variable condenser we are changing the resonant frequency of the turned circuit. Thus, it is possible to tune in stations of different frequencies.

Parallel Resonant Circuits

Parallel resonant circuits also appear in radio receivers. In a parallel resonant circuit the current through the coil is equal to the current through the condenser. The inductive reactance is equal to the capacitive reactance as in the series circuit. The total line current becomes small and is equal to the current through the resistor. At resonance the line current is a minimum in the parallel circuit. This means that the impedance is a maximum.

The curves of Figure 5 also apply to the parallel resonant circuit except that the vertical line to the left of the curves should be labeled impedance instead of current.

Color-Corrected Lenses Prevent Rainbow Effect

BY MEANS of electrical filters it is possible to divide the complex frequencies that make up a speech current into their component "pure" frequencies —which range from 16 to about 16,000 cycles per second. If the frequencies of sound thus separated are reunited by connecting the circuits in parallel—all the circuits that carry each separate frequency—the original sound can be recreated.

Similarly, white light can be divided into the separate frequencies or wavelengths of which it is composed by passing a beam of light through a wedge-shaped glass—a prism. The result will be to project on a screen a rainbow effect or spectrum, composed of all the different colors that go to make up white light. By interposing a second prism, however, all these different colors are, so to speak, connected in parallel, and assembled to form white light again.

A lens is not wedge-shaped; it is not a prism; but a lens may be considered to be wedge-shaped in a partial way—it does have some tendency to break up white light into its component colors, a tendency referred to as "chromatic abberation."

This tendency, or aberration, could be overcome by interposing a lens of exactly opposite design, in order to re-assemble the scattered colors; but if that were done the focusing effect of the one lens would be offset and neutralized by the focusing effect of the other, and the result would be nearly the same as if no lens had been present at all.

To overcome chromatic aberration without losing the focusing effect of lenses, advantage is taken of the fact that lenses made of different materials—different kinds of glass—differ decidedly with respect to chromatic aberration.

Thus, the chromatic aberration produced by a lens of flat glass (for example) can be overcome and neutralized by interposing a lens of crown glass, or vice versa, without completely sacrificing the focusing effect for which the lens exists.

In good quality projection lens assemblies this practice is followed, the result being to provide the necessary focusing without introducing—or rather, in addition to cancelling—chromatic aberration. Lens combinations so designed are commonly called achromatic. Except for the use of achromatic lenses in projection, the theatre screen would display undesired rainbow effects.

The lens combinations that prevent this result commonly consist of lenses of different shapes and different kinds of glass cemented together with Canada balsam in such a way that to a casual glance the combination appears to be one solid glass piece. But that is not so and it is very important in cleaning lens surfaces not to use cleaners (such as alcohol) which may dissolve the Canada balsam and permit the glass components to come apart.

ALTEC AGREEMENTS SIGNED

D. A. Peterson, Altec Service Corp 's Philadelphia district manager, reports renewing service agreements with the following: Hamid's Million Dollar Pier, Atlantic City, N. J.; Castor Theatre, Philadelphia, and Clifford, Flynn & Co. circuit of theatres in Montrose, Mifflinhurg and White Haven, Penna.

Agreements also have been renewed with Skouras Theatres Corporation for regular periodical inspection service and repair and replacement parts for sound reproducing equipments in 64 theatres in metropolitan New York area, Bert Sanford, New York district manager, announced.

W. Connor, Connecticut district manager, states that new agreements have been completed with Caldwell Amusement Company's Roxy Theatre at Caldwell, Ohio; the Grand Theatre, West Lafayette, Ohio; Hi-Land, Louisville, Ky., and a renewal for service with the Triangle Theatre, Pittsburgh, Pa.

Jack Gregory, Seattle district manager, announces renewed agreements with Black Hills Amusement Circuit in Nebraska and South Dakota.

New service agreements have been signed with Bertha, Chicago; Cozy, Milaca, Mich.; State, Waterloo, Iowa, and Praga, Chicago, according to R. Hilton, Chicago district manager.

Henry Moog, Atlanta district manager, announces signing of new agreements with W. A. Prewitt Jr. Theatres in Hattiesburg, Miss., and Jennings, La.; also the Ritz, Bogalusa, La., and Marcilla, Rockingham, N. C. Renewals were announced from J. R. Moffitt's Carver and State Theatres, Montgomery, Ala.

Eleven new service deals have been consummated with the following theatres, according to Jack Zern, Dallas district manager: Fain, Newton, Tex.; Alameda, San Antonio, Tex.; Valley, Muleshoe, Tex.; Rio, Lampasas, Tex.; River Oaks, Fort Worth; Vela Tent Show, Alice, Tex.; Columbia, Anadarke, Okla.; Broncho, Edmond, Okla.; Arcadia, Maud, Okla. and Paramount, Dewey, Okla.

NOVEMBER QUESTION

1. A parallel circuit contains a 10-ohm resistor, an inductance reactance of 5 ohms, and a capacitive reactance of 20 ohms. The line voltage is 100 volts. Find the currents through the resistor, coil, and condenser. Find the total line current.

The correct answers to this question will appear in the next issue.

Guessing

can be expensive



Guessing can be expensive at any time but particularly so today with the present limitations on new projection room equipment and with the uncertainties of replacements. Every projectionist should know the whys and wherefores of his equipment. He should know what to do and what not to do when the equipment fails to function properly—and how to keep the show going until the service inspector arrives at the theatre.

PROJECTIONISTS' SERVICE MANUAL is a complete, compact compilation and a valuable reference work. All items therein are grouped according to classifications and contain sound practical suggestions relating to the many projection room troubles—their causes and how to remedy them.

A copy of this valuable trouble shooter should be in every projection room for instant reference and as a trouble guide. Many I. A. local unions have ordered this book in bulk and placed a copy in each projection room. The price is right —only $3 per copy, postage prepaid. Order your copy now or ask your local union secretary about our special low-price bulk offer.

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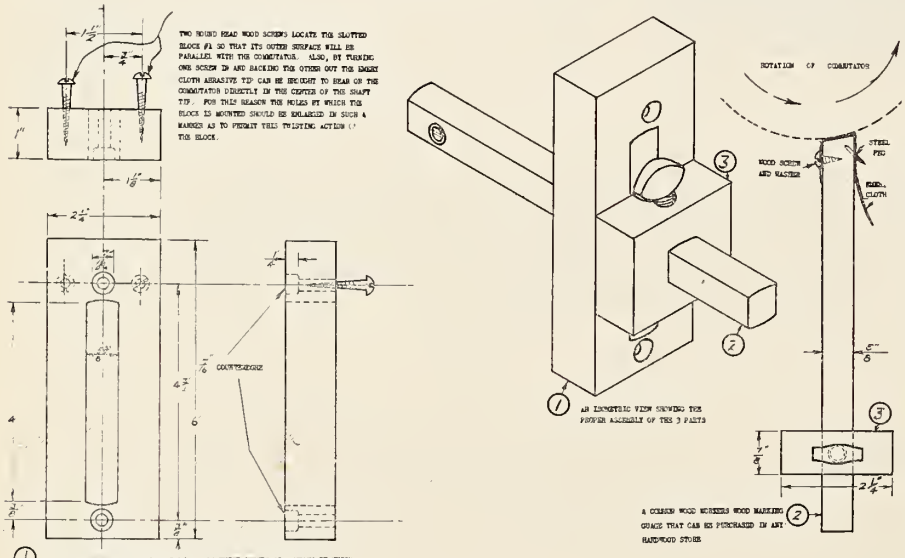
This department is a collection of random thoughts and some not so random: fact, fancy and opinion relating to the man behind the man behind the gun—the serviceman. The prime purpose of this section is to promote a closer relationship between serviceman and projectionist based on a better understanding of their mutual problems through an exchange of news and views, kinks and kicks. To this end, contributions relative to any phase of the serviceman's activities are invited.

A Simple Device for Resurfacing Commutators

I have perfected a simple device for resurfacing commutators which should interest my fellow craftsmen. I have been using one of these tools on a Hertner Type D-20-20 Transverter for the past four years with excellent results. The armature has never been removed for turning down in a lathe since its installation. As a matter of fact, the commutator was eccentric when it was installed due to improper centering in the lathe. Seven months elapsed before it became necessary to again use the resurfacing device for truing up the commutator. Keeping the mica undercut is all that is necessary with this tool.

The device is very easily mounted on the yoke or end bell directly over the commutator with two machine screws. It is not necessary to lift the brushes as the entire operation can be carried out while the machine is in full operation during the show. Merely advance the cutting tip toward the commutator until it engages the surface of the commutator—not too firmly—then move it over the surface of the commutator until no bumping or roughness can be detected when placing the fingers on the tension arms of the brush holders.

Referring to the diagram below, you will note that this device consists of two essential parts—(1) a block of hardwood with a slot cut in it to receive (2) a common wood marking guage altered as shown in the drawing. The two projecting wood screws on the block serve the purpose of locating the block in such a manner that its surface (outside) will be parallel with the surface of the commutator. They also serve to bring the cutting tip into contact with the commutator at the desired point. The holes must be counterbored to permit the sliding member to pass over the heads of the machine screws.



Note too that the rotation of the commutator is against the angle of the cutting tip. The shaft of the wood marking guage should be a snug fit in the slot of the hardwood block, yet permitting it to be moved easily and freely through the course of the slot. By following the instructions and referring to the drawing a skilled projectionist should be able to construct this handy device for his own use.—M. Huffaker, *L.* 106, *Marion, Ind.*

How to Keep Collar Tight on 710-A Drive

I have had considerable trouble with collars on shafts of the 710-A drives working loose. This condition may be prevented by using the 3/16" small bristo screw on the collar.—I. E. Rice, *ALTEC.*

Sign Flasher Interference

If you have a 707-A control cabinet and are having trouble in eliminating interference in the system amplifiers, as caused by sign flasher contacts or other such devices, check the a.c. supply connections in the control cabinet.

I encountered such a condition recently. All ground connections were found to be satisfactory, except the line connection to the supply terminals of the 707-A cabinet. These were found to be reversed, which placed the transformer windings in the ground leg instead of the hot leg. Obviously a potential was established between the line ground and No. 2 a.c. supply terminal of the 42-A amplifier, whenever the KS-6203 switch was in a position to raise or lower the line voltage. Correcting these a.c. line supply connections remedied the trouble and eliminated the interference.—I. L. Robbins, *ALTEC.*

Equipment Servicing Tip

Since there are as many as six projectionists in each projection room I service and they all cannot be contacted on routine servicing calls, I installed a modern binder clip in the upper right-hand corner of each amplifier. This enables each projectionist to record any difficulties he encounters with the equipment and helps me considerably in checking for any trouble.—N. Ripp, *RCA.*

Repairing Feed Shaft S-14125 in Simplex 19000 Lamphouse

Probably other inspectors will appreciate this item on the feed shaft S-14125 in the Simplex Series 19000 lamphouses.

The S-14125 shaft transfers power from the arc feed motor to the carbon feed screw. Shaft S-14125 has a worm gear cut into shaft about one inch long on the lower end. Top of shaft S-14125 has a

(*Continued on page* 34)

PROJECTION LIFE OF FILM

(Continued from page 10)

have indicated that double the number of projections could be obtained from films which are exactly centered on the intermittent sprocket compared with those which are only slightly misaligned.

The relation between the tension of the film in the gate and the number of projections necessary to produce complete breakdown is shown in Figure 11. It will be noted that on this particular machine the number of passages vary from about 300 at a tension of 30 oz.* to 3000 at a tension of 8 oz. At tensions lower than 8 oz. the samples were not run to breakdown, but were removed after 3000 passages and examined for wear.

On the projector on which these tests were run we could see no difference in steadiness of the screen image with tensions greater than about 4 oz., but below this point there was definite unsteadiness.

A survey of a number of theatre projectors in our district showed gate tensions ranging from about 20 oz., to about 10 oz. From the curve we see that these two extremes in tension would produce a five-fold change in the wear life of film.

This relationship between the number of projections and the gate tension represents but one series of tests on one type of projector. On this projector, the gate tension may be changed by means of a thumbscrew which alters the loading of the central coil springs which, in turn, controls the pressure on the center tension pads.

There is some evidence to indicate that whereas the over-all effect of tension on most projectors may be the same as that just given, it is much more difficult to determine. For instance, in many of the older types of projectors the gate tension is controlled by individual cantilever springs, the adjustment of which can be made only by hand manipulation, *i. e.*, by bending the springs. Moreover, on many types of projectors in which the film is not positively edge-guided through the gate, a change in gate tension produces a change in alignment which in itself alters the result.

The answer, then, to the question "How many times can film be run through a projector?" appears to be "It will run as many times as we wish to make it run." If the pitch of the present intermittent sprocket is altered so as to avoid the tearing action of the sprocket teeth against the film perforations, and if the questions of alignment and tension can be solved in cooperation with the projectionist, it is believed that most films are capable of delivering many times the number of projections they will ever be called upon to make.

(TO BE CONCLUDED)

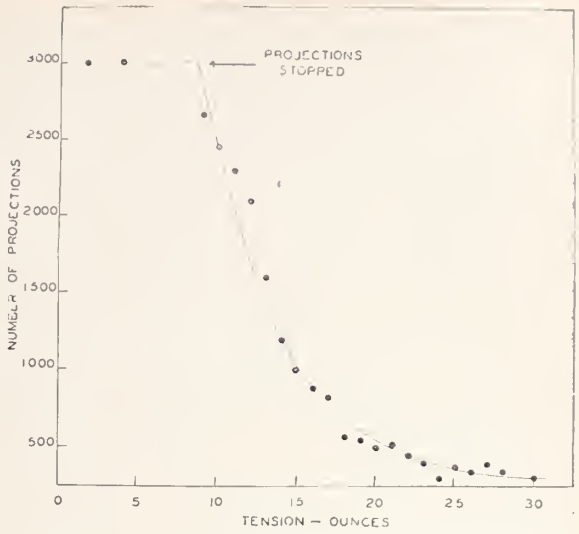


FIGURE 11.

Relation between the tension in the gate and the number of projections that produce film breakdown.

* The tension in the gate can be measured easily by inserting a short strip of film in the gate and withdrawing it upward through the gate by the steady pull of a hand scale, or if preferred, by other mechanical means, so that the force required to move the strip in the gate can be measured. On a theatre projector, the upper magazine must be removed to facilitate withdrawing of the test strip, or a special jig must be used which allows the tension to be measured with the magazine in place.

U. S. HAS OVER 70,000 OUTLETS FOR 16-MM FILM

In the United States there are available a total of 70,000 outlets for 16-mm films, which includes schools, churches, clubs and business firms, according to figures released following a survey made by Telefilm Studios of Hollywood. it was announced by Joseph A. Thomas, president. He also revealed that a circuit of 350 theatres for 16-mm pictures to be erected in small towns throughout the country, is being planned by one exhibitors' organization.

Mr. Thomas also declared that theatres for 16-mm film at present are being erected in European countries to replace many of those destroyed during the war. Advantages claimed are lower cost of building during the shortage of materials, easier installation of equipment, and less fire hazard. He also noted that 16-mm equipment definitely will be more adaptable for television, especially because of shipping advantages, the narrow measure film being non-combustible.

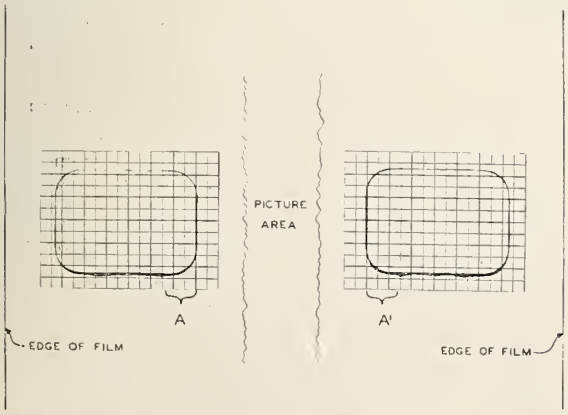


FIGURE 10.

Correct alignment of film with standard positive-type perforations on an intermittent sprocket (actual photograph).

TWO CONCERNS TO HANDLE ALTEC LOUDSPEAKERS IN CANADA

Northern Electric Company, Ltd., and its subsidiary, Dominion Sound Equipments, Ltd., will handle the New Altec Lansing Corporation "The Voice of the Theatre" line of motion picture loudspeakers in Canada and Newfoundland. The announcement was made simultaneously by A. B. Hunt, commercial manager of the Northern Electric Company, Ltd., Montreal; F. E. Peters, general manager of Dominion Sound Equipments, Ltd., and A. A. Ward, vice president of the Altec Lansing Corporation, Hollywood. It is indicated that these loudspeakers will be supplied as standard equipment with the new post-war Westrex Master and the Westrex Standard Sound Systems, manufactured by Northern Electric and distributed by Dominion Sound Equipment.

ADVANCED TO NEW POSTS

Karl L. Streuber, manager of the theatre and sound equipment department of the RCA International Division, announces that Richard A. Glidewell has been appointed sound products sales manager of the division, and Lucien Begin has been made technical consultant on RCA sound recording.

Mr. Glidewell joined RCA in 1938 as sales engineer for sound products. Previous to his new appointment he was sales manager for sound products in the mid-Western States. His new international activities will include the assisting of distributors abroad in planning public address systems in schools, hospitals, factories, stadia and other locations where centralized sound systems can be used effectively.

Mr. Begin, who returned recently from Hollywood and a survey of West Coast sound recording techniques, had been acting assistant to D. W. Lansing, RCA International Recording sales manager.

STEP-BY-STEP ANALYSIS

(*Continued from page* 14)

in the case of V-2. Trace from V-2 cathode through R-8 to ground; and from V-2 grid through R-7 to ground. From the upper cathode of V-3 trace left, down and right through R-13 to ground; and from the upper grid of that tube left and down through R-12 to ground. The arrangement is exactly the same. For the lower half of V-3, trace from cathode left and down to ground through R-14; and from grid right and down to ground through R-18. In every case the grid is biased negatively with respect to cathode by the extent of the voltage drop through the cathode resistor.

In the case of V-4 and V-5, the plate current of both cathodes returns to ground through R-20. The control grid of the lower tube is connected to ground through R-19; that of the upper tube through R-17 and R-18.

Speech Circuits

The photocell, when illuminated through a moving soundtrack, is a source of speech current of the order of perhaps one microampere. R-1 may be regarded as the load upon the circuit. One microampere flowing through one megohm implies a voltage drop of one volt. This fluctuating voltage through R-1 is connected, from the upper end of R-1, directly to the grid of V-1; from the lower end of R-1 to V-1 cathode by way of C-2.

Regarding plate and cathode of that tube as source terminals of an amplified supply of speech voltage, R-7 may be considered the load upon this source. It is coupled to plate through C-4 and to cathode through C-2. Speech current flowing through the parallel part, R-6, is discouraged by decoupling resistor R-24 from trying to get back to cathode through the common power supply and provided with an easier path to cathode through decoupling condenser C-16.

R-7 may be regarded as a source of speech voltage for V-2. Its lower end connects to the cathode of V-2 through C-5. Any desired portion of that voltage drop is then applied to V-2 grid through the volume control slider of R-7.

Consider plate and cathode of V-2 as source terminals of an amplified speech voltage, and R-12 as the load. Trace from plate right through C-6, up through C-7, right and down through R-11 and down to the upper end of R-12. From V-2 cathode trace down through C-5 to the lower end of R-12.

But if the slider of R-10 is moved all the way up (it is all the way as drawn), C-7 will be short-circuited and low frequencies will then pass more easily. C-7 and R-10 constitute an LF tone control, and as drawn are positioned to suppress the lows. Just below this control C-8, in association with the slider on R-12, constitutes an HF control. With R-12 slider up, C-8 will tend to short-circuit highs around the lower portion of that resistor but when the slider is down C-8 is short-circuited and has no influence.

The dotted line shows that the LF and HF controls are ganged together and operated by a single knob; what it does not show is that they are so ganged that when LF response is increased HF response is reduced, and vice versa. In terms of the drawing, the two sliders move up and down together.

Phase Inverter

From the upper end of R-12 trace up and right to the upper grid of V-3. From the lower end of R-12 trace right and up through C-9 to the corresponding cathode of V-3. The speech voltage drop across R-12 is thus wired to the upper half of that tube.

Taking plate and cathode of the upper half of V-3 as source terminals of an amplified speech voltage, trace from plate up and right through C-11, down through R-17 and R-18, left and up to cathode through C-9. R-17 and R-18 may be considered the load, across which the amplified speech voltage appears.

From the upper end of R-17 trace right to the grid of V-4. From the lower end of R-18 trace right, up through C-13, and thus to cathode of V-4. The full voltage

Consider

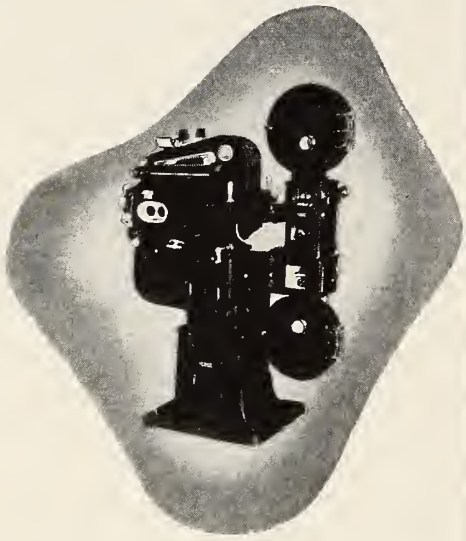
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is thus applied to grid and cathode of that tube.

A fraction of the same voltage is applied to the lower half of V-3. The lower cathode of V-3 connects to the lower end of R-18 through C-10. But the lower grid of V-3 does not connect to the upper end of R-17. It connects to the lower end of R-17, upper end of R-18. That portion of the speech voltage drop which appears across R-17 is thus not applied to the lower half of V-3. In other words, R-17 and R-18 together act as a volume control, reducing the input to V-3's lower section. This reduction in input is proportioned to the amplification of the tube. Thus the output from the lower half of V-3 is at the same volume as the output from the upper half of that tube, but in reverse phase.

R-19 may be regarded as the load connected across the plate and cathode of the lower half of V-3 (through C-12 and C-10). The speech voltage appearing across R-19 is applied to grid and cathode of V-5, directly to grid and through C-13 to cathode.

V-4 and V-5 are thus excited by push-pull input, each receiving speech voltage at the same volume but opposite phase. The primary of the output transformer is the load upon these two tubes. For the return to their cathodes trace from the center tap down, left and down to chassis through C-21; and from chassis back to the cathodes through C-13, R-21 and C-14, across the plates of the output tubes, will have the effect of reducing HF response somewhat; and in association with the primary of the output transformer may constitute a band filter to bring up the response at some desired frequency.

Inverse Feedback

A portion of the output voltage is coupled back to the upper half of V-3, where it appears 180 degrees out of phase with the input speech voltage to that tube. From the upper end of the output transformer secondary trace right, up, left through R-22, down, right and down to the upper end of R-13. From the lower end of the output transformer secondary trace down to chassis, left, and up to the lower end of R-13. A desired portion of the output voltage thus appears directly across R-13. But R-13 provides the grid bias for the upper half of V-3, as already noted. That bias will therefore fluctuate in accordance with the speech voltage applied to R-13. Those fluctuations are 180 degrees out of phase with the speech voltage across R-12, which provides the normal sound input to the upper half of V-3.

The result is inverse feedback. If the feedback were taken from the primary of the output transformer, instead of from the secondary, it would be in phase, and the amplifier would go into oscillation. Being inverse feedback, it acts to suppress harmonics and improve sound quality.

Output Impedances

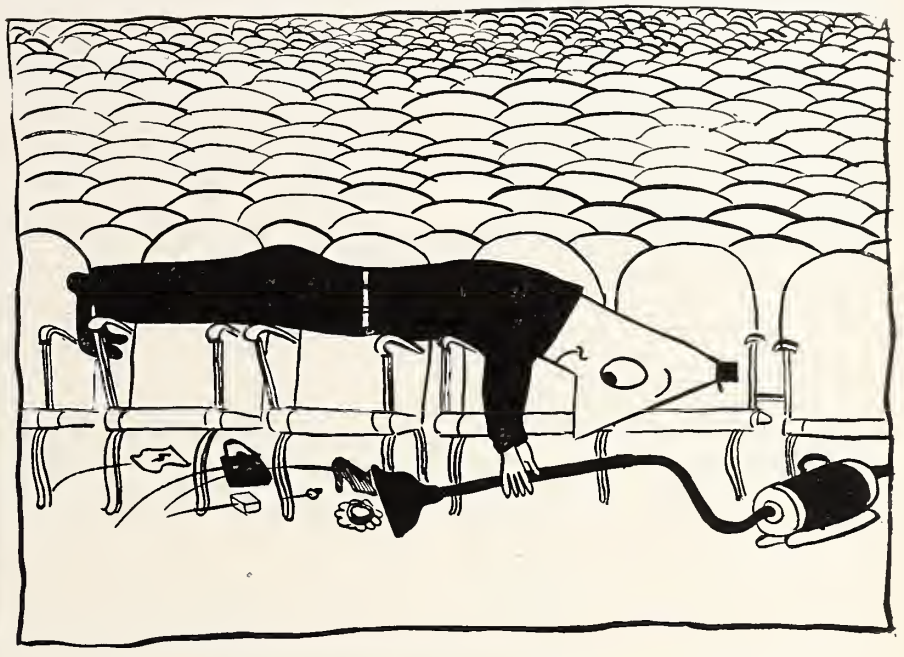
The speaker receptacle is shown to the right of the output transformer. If the speaker cable is wired to the plug in such a way that connection is made with receptacle terminals 14 and 13, the output impedance will be 250 ohms.

An eight ohm output impedance is obtained by wiring the plug for connection to terminals 13 and 16, while 13 and 15 give four ohms.

It will be noted that one side of the speaker cable is grounded to chassis through receptacle terminal 13. Chassis, however, is not grounded to earth, either through the a.c. input or in any other way.

CENTURY TO USE "VOICE OF THE THEATRE" LOUDSPEAKERS

Mr. W. D. Hausler, vice-president and general manager of Century Projector Corporation, announced that all models of the new Century Sound Equipment will be supplied with Altec Lansing Corporation "Voice of the Theatre" loudspeaker systems exclusively.



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Presenting: James R. Forsyth



JAMES R. FORSYTH, who served as secretary of I. A. Local No. 159, Portland, Ore., for about twenty years, until his recent retirement, made his debut on this planet on March 8, 1893. The event took place in the little village of Lakeland, Minnesota, on the banks of the St. Croix, just a few miles each of St. Paul. But his family did not linger long in Minnesota, moving to Oregon where Mr. Forsyth has remained ever since.

In a recent interview he said that unionism and collective bargaining seem to always have been with him, and this is borne out by his work in Local 159. He claims, however, "that it is a privilege and a pleasure to add my meager efforts toward the improvement of working conditions and for the increases of deserved salaries. The problems that came before us often were knotty, but interesting. Some of them were headaches at the time but they seemed to have a way of turning out fairly well."

"Jimmie" Forsyth received his theatrical vaccination at an early age, at a time when his father was interested in a tent show that traveled through the middle west. During his high school days he picked up a little spending money by working at the local motion picture theatre, the Bijou, first as an usher, and then as a projectionist. His early ambition inclined toward a medical career but World War I and other factors contributed to prevent it. Being familiar with the theatre, he continued in that line. He applied for membership in the Portland I. A. local and was initiated on December 10, 1917.

He has used photography and criminology as hobbies and side lines for many years, and at one time conducted a portrait studio. His main photographic interest, however, has been in artistic landscapes and classical subjects. Some of his work has been exhibited in American and foreign salons.

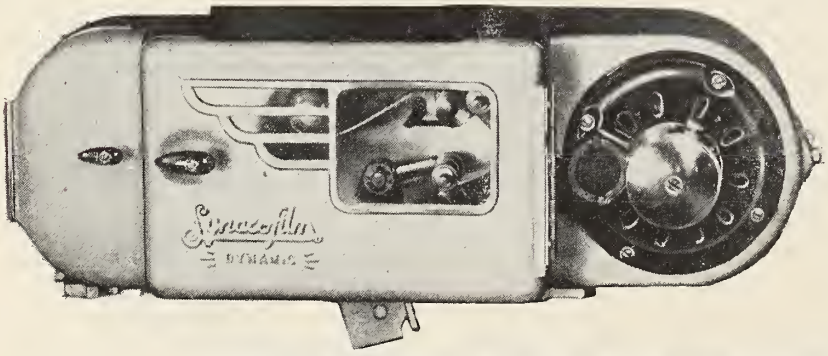
While he is no Philo Vance, Jimmie's knowledge of criminology proved valuable during the recent war. He has quite a library on police methods, types of evildoers, detection and laws pertaining to this work. During the early days of the war he was connected with the police reserves and auxiliary in the instruction of men who had volunteered for guard and patrol duty. With the aid of his library he wrote a series of lectures on police duty that was used in instruction classes, and for this service he was honored with the title of police lieutenant.

While working as a committeeman during an American Legion membership campaign Jimmie found it necessary to call upon a prospective member, Maurie Selstad, formerly of Milwaukee, Wisconsin. Miss Selstad had recently been discharged from the Army as a Wac. Romance budded, bloomed and ripened shortly thereafter, with the result that a little over a year ago Jimmie and Miss Selstad were married. The ceremony took place in Denver, followed by an extended honeymoon in which California played an important part.

P. S.—Miss Selstad also joined the Legion.

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LETTERS TO THE EDITOR

Anent Resurfaced Screens

To the Editor of I. P.:

I read with great interest the article in your September issue entitled "Screens: From a Sound Engineer's Point of View". This article is an accurate one and is to a large extent the same story that "Pop" Richardson told for many years prior to his death.

For the past several years, there has been a screen on the market known as the Walker Plastic Moulded Screen whose reflective properties and characteristic features to a large extent meet the problems set forth in the aforementioned article. It occurs to me, however, that in the selling of this product, these particular features may not have generally come to the attention of the projectionist, as I presume it is generally discussed with the theatre owner. You might, therefore, be interested in bringing this information to the attention of your readers.

It is a fact that all makes of screens that are perforated after they have been coated do not have clearly cut holes. To a certain extent this is the effect of the sharpness of the die. In any event, at best it is inevitable that the thread ends will project out into every hole. The results are exactly as outlined in the article. An added result which does not directly affect the sound is that these thread ends absorb moisture and after a reasonably short period of time the threads break down the smooth screen surface. This results in the general deterioration of the reflection characteristic.

For a number of reasons we never recommend resurfacing of screens, particularly as the perforations are likely to fill up. Close examination of the screen will indicate that within 3 or 4 months after it has been resurfaced, it is no better than it was before.

The Walker Plastic Moulded Screen differs, among other things, from any other screen in that it is *not perforated after it is coated.* The backing material is first perforated and seamed together. The screen is then coated as a complete unit with a very heavy plastic material. It is thus seamless. The circumference of each perforation is sealed with the plastic material so that it is impossible for any thread ends to project into the holes. Since the screen is coated with a curved surface, each hole is actually shaped as an exponential horn. This results in excellent sound transmission and absolutely minimizes the possibility of dust collecting in the perforations.

Furthermore, the hard plastic surface which will not disintegrate can be more easily brushed free of dust. A special cleaner is also made available for restoring the original reflection characteristic of the screen every 6 or 12 months, depending upon local conditions which insures the continuous high quality of sound transmission.

JAMES FRANK, JR.
Branch Manager, N. Y. C.
National Theatre Supply Co.

More Kind Words for I. P.

To the Editor of I. P.:

Within a few weeks I expect to be discharged from the Armed Forces, and I would like you to send future issues of INTERNATIONAL PROJECTIONIST to my home in Carteret, N. J.

At this time I would like to say that during my service with the Air Corps, I. P. was my favorite reading matter, and if it were not for your very interesting publication I would have been out of touch with developments in the industry. Thank you again for sending me the magazine each month.

JOSEPH L. PUSILLO
APO, New York, N. Y.

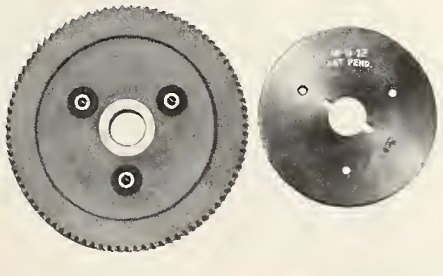
VALLEN IS BACK ON PRE-WAR DELIVERY SCHEDULES

Vallen, Inc., manufacturers of noiseless tracks, automatic curtain controls, and special equipment for theatres, schools, industrial auditoriums, etc., of Akron, Ohio, has returned to normal pre-war delivery schedules, according to a company announcement. Substantial shipments of standard Vallen all-steel tracks, rear fold track and "Round-the-Corner" track equipment already are being made, E. J. Vallen, president, explained.

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W. E. TO CONSTRUCT PLANT FOR BELL EXPANSION

Western Electric Company announces that it has purchased property and will construct a new electronic components plant at Allentown, Pa, as a part of the Bell System's two billion dollar post-war construction program. In the new plant General Electric plans to manufacture vacuum tubes, quartz crystals, temperature sensitive devices and other precision products for use in Bell System communications facilities and in other commercial applications. The new plant when operating at capacity will employ about 1,500 people.

Plans call for an office building having 50,000 square feet of floor space, and a manufacturing building of 250,000 square feet, with related facilities such as a restaurant, medical offices and recreation rooms. Because of the need for dust-free air as well as temperature and humidity controls, manufacturing areas will be fully air conditioned. Approximately one year will be required to complete the plant after construction work begins.

C. G. Stoll, W. E. president, in commenting upon the new unit, predicted that vacuum tubes, quartz crystals, resistors and other electronic components will find increasing use in the telephone system and in related fields during post-war years. These products involve glass working, gas-filling operations and vacuum equipment, as well as a high degree of production craftsmanship, specialized facilities, and more exacting process controls, as well as manufacturing conditions approaching surgical cleanliness.

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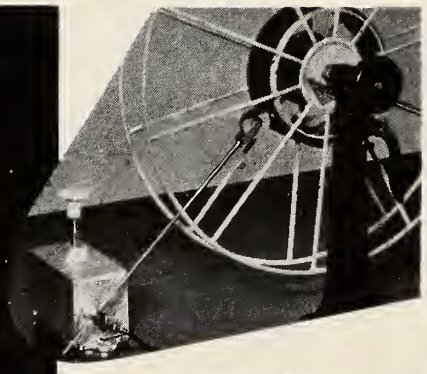
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SMPE ABSTRACTS

(*Continued from page* 16)

and laboratory screening rooms should perform so as not to cause any undesirable screen effects which could be mistaken for errors made by the cameraman or poor work in the laboratory.

A study of conditions encountered, together with experience gleaned from many installations of projection equipment in screening rooms during the past few years, has taught us that some modifications of standard equipment are desirable in order to obtain the best results.

This paper deals with the importance and the means of eliminating or minimizing such factors as vibration, film weave, and flicker; facilitating the running of green film and film splices; obtaining the proper intensity and quality of light on the screen; and maintaining the proper ratio of viewing distance to picture size.

A LOUD SPEAKER SUITABLE FOR CRITICAL MONITORING

Maj. Paul W. Klipsch
Southwestern Proving Ground, Hope, Ark.

Too frequently, the radio listener or theatre patron hears rumbles and other sound defects that escaped the monitor. The monitor studio in many cases is restricted in size, and therefore uses speakers of inadequate dimensions to radiate the spectrum contained in the program.

There is one way possible to reduce size without sacrifice in quality; namely, by reducing the radiation angle. Any speaker operated near a wall will work against a higher acoustic load than would be the case in the absence of the wall. The reflector produces a mirror image which doubles the effective area of the radiator. Obviously, then, a speaker in a corner would be helped by the added wall surfaces. If designed specifically for corner operation, a speaker could be reduced in size by the factor ⅛ and exhibit the same performance as a full-sized unit. This fact makes possible the construction of horn speakers of moderate size.

This paper offers a resume of recent literature on corner horn speakers, and shows that units comparable in size to a console radio receiver can exhibit performance equal in quality to large speakers.

A NEW 16-MM BUZZ TRACK RECORDER

M. G. Townsley
Bell & Howell Company

A buzz track recorder has been developed for making 16-mm buzz track directly, which produces a superior type of buzz track having a very low noise to signal ratio and very high accuracy of track location.

MEASUREMENT AND CONTROL OF DIRT IN MOTION PICTURE PROCESSING LABORATORIES

N. L. Simmons and A. C. Robertson
Eastman Kodak Company

The presence of dirt in a film processing laboratory usually results in an impairment of the quality of motion picture films. Dirt can come from outside air, personnel, equipment, or processing solutions.

Air filters are discussed. Their efficiency can be measured by a recorder, which is described briefly. The problems caused by contamination by personnel are described and

solutions suggested in the form of special clothing, the designation of "clean areas," etc.

Equipment for processing laboratories should be designed with its special needs in mind. Appearance is secondary to utility, which in this case means the absence of any source of small dirt particles.

Special precautions for processing solutions include softened water, filtration, and the use of special additional agents. Examples are given of several surveys in the trade, and the "tacky dish" technique is described, as well as other microscopic methods.

PRELIMINARY SOUND RECORDING TESTS WITH VARIABLE-AREA DYE TRACKS

R. O. Drew and S. W. Johnson
RCA Radio Victor Division

The introduction of new color emulsions to the industry makes it necessary for the sound engineer to investigate problems in connection with the recording and reproducing of quality tracks on this new medium.

This paper discusses the results of some preliminary tests made with variable-area tracks on Ansco reversible monopack color film. The tracks were processed in exactly the same manner as for picture and therefore are of dye composition.

Three specific methods of printing are discussed. Quantitative measurements of tracks containing modulated and constant-amplitud tones reproduced with the new gas-filled blue sensitive and the ordinary red-sensitive photo tubes are given.

CELLO-VISION FILM SPLICING AND REPAIR MACHINE

Armour Wallingsford
Republic Studio, Hollywood, Calif.

This machine is a compact portable meta device, capable of making straight or diagona splices, restoring lost and torn perforations and repairing either pictures or sound tracl without replacing sections. This is accom plished by the application of a good qualit of pressure sensitive tape which is applied to the film and perforated in exact registra tion with the film perforations. By using a specially prepared tape, any splice may b blooped as it is made without extra operations

The splicer is composed of a cutting anvi which removes one complete frame or any desired section of film, and a splicing anvi which completes the straight or diagona splice, makes the perforations, and trims the edges. The perforating is controlled by four retractable registration pins which may be operated in unison, or in any desired combination. An upper arm containing eight punches, a pressure plate, and trimming shears, when lowered onto the die anvil, completes the film splice on one side. When this operation is repeated on the reverse side, the splice is ready for use.

The tape is contained in a readily accessible built-in housing which facilitates easy replacement of the roll.

This film splicer reduces by approximately one-half the manual movements required by the present method. It can be placed in any convenient position on the editor's table, and splices may be made without removing the reels, thus eliminating the use of paper clips.

At the present time the three models of this machine for eight, sixteen, and thirty-five millimeter film are in the process of development. The description herein is made from the author's model, which has been in constant use for the past six months in the Editorial and Sound Department of Republic Studios, North Hollywood, California. The machine was in actual use splicing picture and sound track area without affecting sound track for dubbing purposes. This was accomplished on the last six pictures produced by Republic Studios without a single failure.

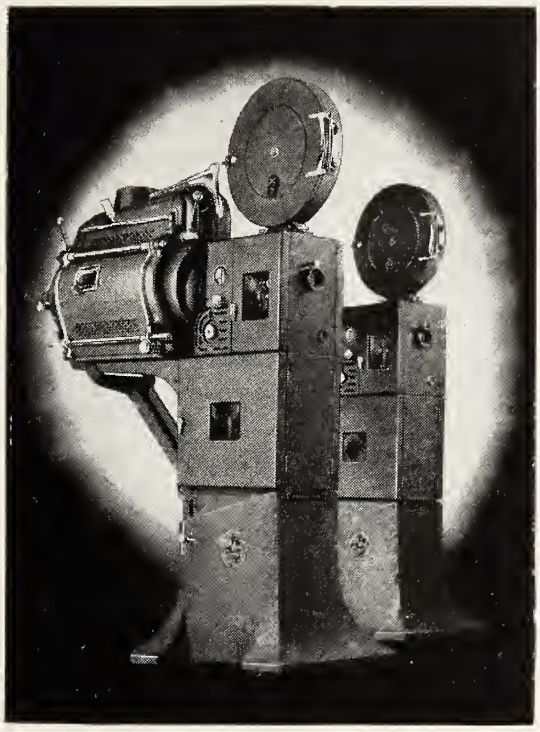
NONINTERMITTENT MOTION PICTURE PROJECTOR WITH VARIABLE MAGNIFICATION

F. G. Black
Research and Development Lab., New York, N. Y.

In the course of the Navy aviation training program, a projector had to be designed to project the image of a target vessel on a curved cyclorama screen, and to make this projected image perform all the real and apparent motions of a real battleship, as seen from the cockpit of a maneuvering aircraft.

The projected image has to wander all around the horizon. It has to become larger and smaller under due consideration of the angle of depression corresponding to that particular range. Besides, the projected target has to be able to make all kinds of turns and maneuvers to simulate actual combat conditions. To achieve all this, a special nonintermittent 16-mm film projector for variable speed and variable magnification had to be built.

(*Continued on next page*)



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X-Ray Is Most Powerful Tuberculosis Weapon

According to John J. O'Neill, science editor of the New York Herald-Tribune, the most powerful, practical and speedy weapon for combating tuberculosis that has been made available to the human race is the low cost X-ray photograph using moving picture films or paper negatives to record the condition of the lungs. This makes possible, he states, the examination of the entire population of a community and discovery of tuberculosis in its early, most easily curable stages.

The 39th Christmas Seal Sale of the National Tuberculosis Association this year marks the 50th anniversary of the magnificent gift of the X-ray that science gave to humanity. It was on Nov. 8, 1895, that Professor Wilhelm Konrad Roentgen announced that he had discovered a form of radiation which had the property of penetrating the human body so that photographic records could be made of internal conditions.

It also was discovered that these rays would reveal tuberculosis germs long before the affected individual had any symptoms to warm him of the presence of the disease. Technical advances have materially cut the cost of photographs and the time of processing. Today the entire routine of making an X-ray picture of the chest can be completed in 25 seconds.

The National Tuberculosis Association and its 2,500 affiliates are constantly calling to the attention of communities the importance of taking the necessary measures to prevent the spread of tuberculosis. These voluntary agencies deserve unstinting support, and one important way in which we can give that support is by generous purchases of Christmas Seals, which finance their programs.



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(Continued from preceding page)

BEHAVIOR OF THE 1P37 BLUE-SENSITIVE PHOTOTUBE IN THEATRES SOUND EQUIPMENT

J. D. Phyfe
RCA Victor Division, Indianapolis

A new phototube designed to provide optimum performance when used in soundheads with films having standard black and white silver sound tracks, or with color films having either dye or edge-treated sound tracks, has been developed in the laboratories of the RCA plant at Lancaster, Pennsylvania.

Some results of laboratory tests and field observations when this new phototube is substituted for the standard red-sensitive 868-type phototube are reported.

THE ILLUSION OF DEPTH IN MOTION PICTURES

Lt. Howard T. Souther
Signal Corps, U. S. Army

Motion pictures are not realizable as such until they are perceived by the brain through the eye. The manner in which the eye operates is dealt with, particularly those functions having to do with perceiving objects as solids. The intelligent employment of motion picture taking equipment now in use, in making it conform to the requirements of the eye, can result in an important contribution to three dimensional perception from the screen. Some fifteen (15) aids in promoting the illusion of depth are dealt with in this paper.

CARBON ARCS FOR MOTION PICTURE AND TELEVISION STUDIO LIGHTING

F. T. Bowditch, M. R. Null, R. J. Zavesky
National Carbon Company

Photometric and spectral energy distribution data are given for typical carbon arc light sources used extensively in motion picture studio lighting. The balanced color quality and low infra-red content which make these sources valuable in motion picture photography are reviewed from the standpoint of the requirements of television studio lighting. The conclusion is reached that as television expands to justify adequate studio facilities, the carbon arc should find a place similar to that which it now holds in the motion picture studio.

PHOTOTUBE FOR DYE IMAGE SOUND TRACK

Alan M. Glover and Arnold R. Moore
RCA Victor Division

In view of the use of dye image sound track on new type color film, a phototube has been developed with characteristics suitable for sound reproduction from these films as well as from ordinary silver tracks. It is a gas filled, high sensitivity phototube for use in standard reproducing equipment. The maximum spectral response occurs in the blue blue-green region of the spectrum. Details of construction, sensitivity, characteristic curves, spectral response, frequency response and life are presented.

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IN THE SPOTLIGHT

(*Continued from page 19*)

ing branch of the U. S. Army Signal Corps; Charlie Dentelbeck, chief projectionist for all Canadian Famous Players theatres, and his assistant Tommy Hoad. (Incidentally, Hoad read a most interesting paper on dual projection, an abstract of which appears elsewhere in this issue.) Dave Siegel and Lou Lodge, Toronto Local No. 173, were also among those present.

Lester Isaac, member of Washington Local No. 224, and supervisor of projection for all Loew's, Inc., theatres in the country, and his assistant, Morton D. O'Brien, member of Nassau County Local No. 640, attended the sessions. Joe Engle, also of Local 640, was a regular at the meetings.

New York City Local No. 306 was represented by Herman Gelber, president; Morris Kravitz, business agent; Charles Beckman, financial secretary; Charles Beckman, Jr., supervisor of projection for the U. S. Army Signal Corps; Cecil Wood, Sr.; Harry Hollander; John Krulish; Manny Gessin; Al Lee; Jack Winick; Herbert Schwartz; John Kohler; Joe Basson, I. A. representative and former president of Local 306; Harry Rubin, projection supervisor for the Paramount Theatre in New York City; Irving Merkur; Paul Kocsis; Harvey Sears, and Dave Narcey. Herb Griffin, president of Librascope, Inc. (a subsidiary of International Projector Corp.) and past president of the SMPE, has retained his membership in Local 306 for well over 30 years.

We believe that to our good friend William C. (Bill) Kunzmann, National Carbon Company representative and the convention vice-president, should go much of the credit for the steadily increasing projectionist membership in the Society. Bill has done more to create good-will for the organization among the members of our craft than any other person we can think of. This last was the 58th consecutive SMPE convention he has attended—a record equalled by none—and we hope that Bill will be around to attend many, many more.

● Dick Green, former secretary-treasurer of the Alliance, is now recuperating from an operation he underwent at the White Memorial Hospital in Los Angeles. Any of the old-timers wishing to write to Dick, and we think that many of them would like to send him a word or two of cheer, may write to him in care of Local No. 165, Hollywood, Calif.

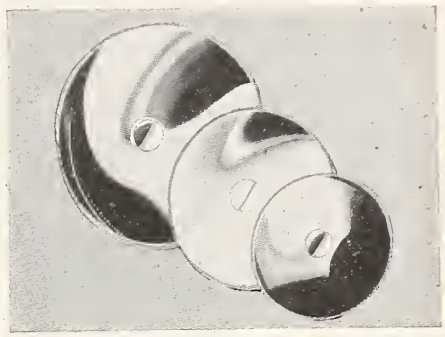
● Recent visitors to the offices of I. P.: I. A. representative Eddie Miller and Frank (Bumps) Coogler, of Houston Local No. 279; Leon Charlip and H. N. Elliott, Toronto Local No. 173; Ed Halliday and Roy Randegger, Chicago Local No. 110; John Shuff, Akron Local No. 364; H. C. Bedford, Baltimore Local No. 181; Edward Dietch, Boston Local No. 182, and Chas. Travis, Schenectady Local No. 314.

● We received a very interesting letter from one of our Canadian readers, Fred Bendell of Local No. 528, Kingston, Ont., which is both timely and sensible. Last year, at his suggestion, the officers of his local union contacted the exhibitors in their jurisdiction and proposed that theatre openings on Christmas Day be delayed to 3 o'clock in the afternoon in order to give the theatre employees a chance to spend at least part of the holiday with their families. Most theatres in Kingston have continuous shows, running from 1 p. m. to 11:30 p. m., and on holidays they *all* have continuous shows, thus affording the employees very little time in which to celebrate the holiday with their loved ones. The theatres all agreed to the union proposal and an advertisement was inserted in a local paper advising the public of the late opening and the reason for it. The public's reaction was most favorable.

This year, writes Bendell, Arthur Sweet, secretary of the local, proposed that the theatres re-open on Christmas Day at 6 p. m., and he has already received assurances from officials of both the Odeon and 20th Century circuits of their willingness to cooperate. No doubt the other theatres will follow suit.

However, Bendell goes a step further and suggests that since exhibitors have always claimed Xmas Eve to make the poorest box office showing of any day in the year, with Xmas Day a close second, why can't all theatres close at 6 p. m. Xmas Eve and reopen at the same time on Xmas Day.

How about it, Mr. Exhibitor?



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25-30 Club Notes

The 25-30 Club opened the first meeting of the season with the addition of many new names to the membership roster. New members admitted to date are Marion Frejman and Julius Lazarus, members of New York City Local No. 306; Charles Turner, St. Louis Local No. 143; Raymond Roe and Lawrence Sherman, members of Syracuse Local No. 376, and Bob Clarke, Jr., Local No. 444, New Kensington, Penna.

Applications for membership in the Club have been received from Walter Austin, New Kensington Local No. 444, and P. E. Thomas, secretary of Local No. 593, Creston, Iowa. Eleven members of Rochester Local No. 253 (five of whom are charter members of the local) have also filed applications for membership—Calvin W. Bornkessel and Lewis Townsend, former presidents of Local 253; Floyd B. Spencer, secretary; Leon E. Burton, treasurer; William H. Holmes, member of the executive board; Jesse J. Seadeek, judge of elections; Charles E. Mason and Louis B. Goler, trustees; Joseph R. Vecchio, delegate to Central Trades, and Paul P. Kuntz and Albert F. Florack, Jr.

Charlie Travis, member of Schenectady Local No. 314, attended the opening session and enjoyed it so well that he promised to attend as many of the regular meetings as he possibly can. Incidentally, the Club's meetings are held at midnight, the second Tuesday of each month. Out-of-town members are urged to attend these gatherings whenever possible—they afford one an opportunity to hark back to the good (?) old days and swap reminiscences with other old-timers.

REMEMBER THIS EMBLEM



Men and women who are honorably discharged from the armed forces are wearing this button. Remember, they have served our country well, and helped save the things you love—your home, your family, and your freedom.

AT YOUR SERVICE

(*Continued from page 24*)

milled flat to take the set screw in the fiber gear S-21126.

Only several teeth of the worm engage the feed screw gear and on several of the lamps I have checked, the worm gear mesh is pretty sloppy, causing only the very top of the worm gear tooth to wear. Rough handling of the manual feed knob will strip this worm gear if it is worn slightly.

When found badly worn or stripped, as I did in one case, a repair can be easily made by sawing off about 5/16" of the shaft opposite the worm. File a new flat on the shaft about 3/8" closer to the worm and about 1/2" wide. Then the S-14125 shaft can be raised so an unworn portion of the worm gear will engage the feed screw gear. No trouble will be encountered in filing or sawing this shaft as it is very soft.

To remove the S-14125 shaft, loosen the set screw in the S-21126 gear. (Remove armature to gain access.) Screw S-809 is backed out and the entire feed screw is pulled back a couple of inches. Shaft S-14125 will then drop out through a hole in the bottom of the lamphouse.—W. R. Opfel, *ALTEC*.

Grounding on W. E. 49 Amplifiers

The base on which the tubes on the W. E. 49 amplifiers are mounted is a separate piece of metal and is insulated from the main frame. Pushing down on the socket base until it hits the stopper bolts in the main frame and sliding over the bolt threads usually causes much noise to be picked up. This indicates poor grounding. The socket frame is grounded through the coil spring, and bridging this spring reduces the noise. Run a wire from the socket base to No. 1 terminal of the terminal strip and all noise will be cleared.—R. O'Toole, *RCA*.

I. A. Elections

NEW YORK STATE ASS'N OF MOTION PICTURE PROJECTIONISTS

Earl Tuttle, Binghamton Local 396, *president;* Melvin Denny, Syracuse Local 376, John Short, Corning Local 480, and D. F. Harrington, Saratoga Springs Local 592, *vice-presidents;* C. F. Wheeler, Geneva Local 108, *sec.-treas.;* W. Stevens, Jamestown Local 286, Edgar Stewart, New York Local 306, H. Paul Shay, Elmira Local 289, Ralph Hayes, Watertown Local 338, and W. Colquhoun, Niagara Falls Local 121, *legis. comm.;* R. Hayes, Westchester Co. Local 650, W. Axton, Glens Falls Local 524, B. Willoughby, Amsterdam Local 313, H. Gelber, New York Local 306, and George Nugent, Troy Local 285, *exec. comm.;* Louis Goler, Rochester Local 253, *sgt.-at-arms.*

ASS'D ELECTRONIC ENGINEERS

Ralph W. Kautzky, New York Local 306, *pres.;* S. H. Hamilton, Lima, Ohio, Local 349, *vice-pres.;* W. K. Bach, New York Local 306, *sec.;* Al Kunze, New York Local 306, *treas.;* Walter I. Wall and Tom P. Prendergast, New York Local 306, *exec. board.*

OHIO STATE ASS'N OF MOTION PICTURE PROJECTIONISTS

Robert Greer, Columbus Local 386, *pres.;* R. A. Mills, Springfield Local 352, *sec.;* Wm. Finnegan, Cleveland Local 27, *exec. board.*

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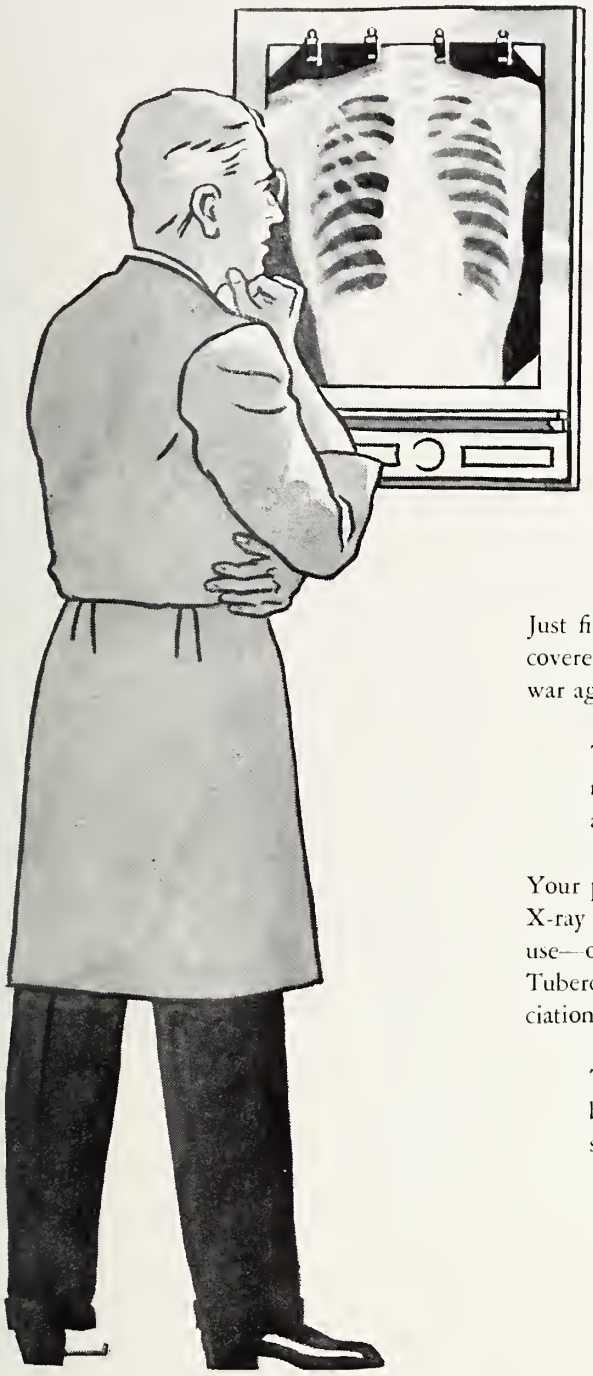
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The X-ray is not a cure, but a means of early diagnosis . . . finds TB when it can be cured more easily and before it spreads to other people.

Your purchase of Christmas Seals helps to perfect X-ray equipment and to encourage its widespread use—one of the many activities of the National Tuberculosis Association and its affiliated associations.

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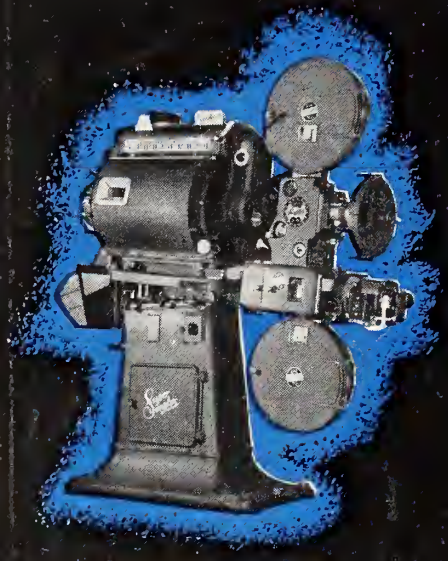
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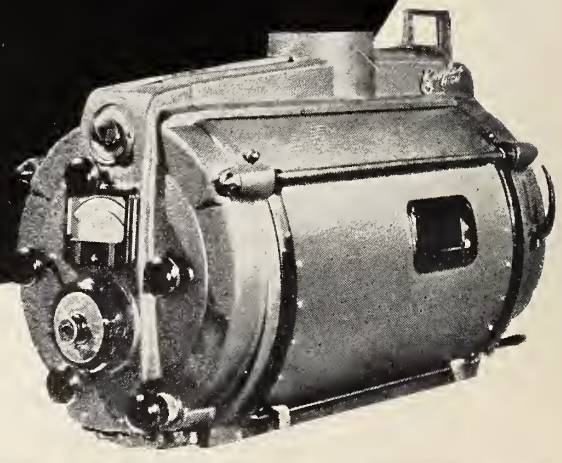
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W. L. Lightfoot, *Associate Editor*

Volume 20 DECEMBER 1945 *Number* 12

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MONTHLY CHAT

INTERNATIONAL PROJECTIONIST extends its best wishes of the season to all those within the industry, to those in the related industries and to everyone in general as our country celebrates its first peacetime Christmas since the tragedy of Pearl Harbor.

• • •

Our good friend D. K. Chastain, of Charlotte, N. C., who has served during the past year as assistant chief and chief of the Hospital Motion Picture Unit for Southeastern Area of the American Red Cross during which time he has visited many hospitals checking equipment and programs, has an extremely interesting suggestion, which he describes as follows:

"I met several I. A. boys at various hospitals as patients who were helping with the movies for their lame and sick buddies. However, I was somewhat concerned about the so-called projectionists who have been taught by the Army and have acquired Army license. This leads them to believe that it will be no trouble to secure good paying jobs when they return to civilian life. Some of these boys have the necessary ingenuity, imagination and skill to become fine projectionists, but the larger number of them are ill-equipped to master the art of projection and its various attendant requirements.

"It is one of the problems many of the locals will have to face in the near future and some of the procedure should be established wherein these boys who have what it takes can be utilized, and those whose capabilities are questionable should be helped and advised to get positions that they would like and can hold."

Mr. Chastian has brought up an important topic. I. A. members, of course, will get their jobs when they are released from the armed services. Those who learned the art in the services, however, are in a peculiar position. There is no doubt that theatre owners would welcome using these men in their projection rooms at lower-than-scale pay, with efforts already having been made along those lines. It seems doubtful, though, that any large percentage of these boys will take such jobs. They simply are not minded to undersell their fellow men.

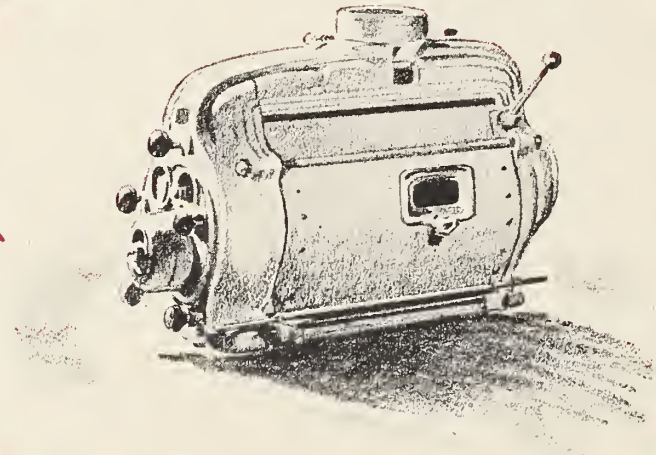
Many hundreds of these service trained personnel, nevertheless, could be absorbed into the industry without harming a single union job. This would be accomplished by having laws passed making it mandatory to have more than one projectionist in a booth. There are far too many one-man projection rooms being operated throughout the country, which are a menace to the lives and safety of the projectionists and to theatre patrons as well. Newspaper headlines too often have told the sordid tale of lives lost through one-man operation. Here is a field then—a wide-open field—in which the ex-service men will fit in. Nationwide pressure by projectionists' and veterans' organizations undoubtedly would speed the enactment of these critically needed laws.

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VOLUME XX DECEMBER 1945 NUMBER 12

Introduction To Vacuum Tube Oscillator Circuits

By *LEROY CHADBOURNE*

USE OF common types of amplifier tubes as oscillators, rather than as amplifiers, is becoming increasingly important to the projectionist. Oscillator tube circuits are not new, they are as old as the tube itself, but they are still new to the projection room. However, tubes are now being used as oscillators in 16-mm projectors, to supply the exciting lamp.

Oscillators are indispensable to television, and not one but several different oscillator arrangements will be included in any television installation that may come to the theatre.

The schematic drawing of an oscillator circuit often looks very much like that of an amplifier; the projectionist may therefore be confused unless he has a reasonably clear idea of what an oscillator is, what it does, and what different types of oscillator circuits exist.

These circuits are very numerous. There are more different ways of connecting a tube as an oscillator than as an amplifier. The projectionist will remember that amplifiers can be single or push-pull, can be Class A, Class A-prime, Class B or Class C; they can be d. c. amplifiers, audio frequency amplifiers (used now in the projection room), intermediate frequency and high frequency amplifiers, etc. The variety of oscillator circuits is even greater.

Since lengthy books can be (and have been) written about the use of vacuum tubes as oscillators, this short article will not exhaust the subject nor more than barely touch its surface. The reader will find here only an introductory presentation or birds-eye view of the matter, with a brief step-by-step analysis of a few of the commonest oscillator circuits, and some mention of their troubles.

Basic Requirements

The essential function of an oscillator tube is that of a converter, operated by d. c. and delivering a. c. at its output terminals. The d. c. supply needed by this device is the familiar filament current and plate voltage, as in any amplifier circuit. Control grid bias is seldom used, but in some circuits a screen grid tube is employed and screen voltage is applied.

So far as these power supplies are concerned, the arrangements sometimes resemble those of a conventional amplifier circuit. There are exceptions, however. There is a "self-rectifying oscillator" for example, consisting of two tubes connected like full-wave rectifiers (which they are), serving simultaneously as oscillators and thus rectifying their own plate voltage. In general, however, the power supplies to an oscillator circuit may be so similar to those driving an amplifier circuit that at first glance the projectionist may think he is dealing with an amplifier. This tube, also, is often of the common amplifier variety, and in fact any amplifying tube whatever can be made to act as an oscillator.

The distinguishing requirement of the commonest form of oscillator circuit is feedback between output and input. When the oscillator is a single tube, this means feedback from plate (or output) to grid (or input). When two or more tubes work together as an oscillator circuit, the feedback may be from the plate of the second tube to the grid of the first, and in that case as much care may be taken as in amplifiers to prevent feedback with the circuits of either tube alone.

There usually is no input to the grid of an oscillator; in amplification, input must be provided from the photocell, microphone, or other source of the

Vacuum tube oscillators, inherent components of television equipment, are also entering the projection field proper via 16-mm apparatus. This use of tubes, and the connections and circuits involved, will be unfamiliar to projectionists whose previous acquaintance with tubes has been limited to their function as amplifiers. A short account of the more common oscillator tube circuits is given here.

voltage to be amplified; in an oscillator circuit, the only input is the feedback from the plate.

Any minute irregularity in the plate voltage or in the filament emission is enough to start the process of oscillation. That irregularity, however small, is fed back to the grid and amplified. It then appears in amplified form in the plate curent; is fed back to the grid to be amplified still further, and so on until the limits of the tube are reached.

There is loss in any feedback circuit, as in any other circuit. If the loss in the ccurse of feedback is greater than the gain (amplification) of the tubes, the process just mentioned does not take place, and the circuit remains merely an amplifier circuit. For example, there is a type of inductive oscillator circuit (Figure 1) in which feedback from plate to grid is effected by transformer action, and the two coils of the transformer are so arranged that they can be placed at different angles with respect to each other. If the angle between the coils is made so wide that the resulting loss in feedback cannot be overcome by the gain of the tube, the system stops oscillating. Narrow the angle, and oscillation is resumed.

In such a circuit oscillation can also be prevented by increasing the distance between the coils, or by reversing the connections to one of them. Reversing the connection results in "inverse feedback," and an inverse feedback circuit does not oscillate.

Analogous Oscillators

In the type of oscillator in which the action depends upon feedback between plate and grid, the loss in feedback must be less than the gain in amplification: feedback phase relations must be such that changes in plate *current* are approximately in phase with the corresponding changes in grid *voltage*. When these conditions are met, a. c. will appear in the plate circuit of the tube and will be sustained by being constantly fed back to the grid.

One explanation often given is approximately as follows: Let us suppose any small change in conditions which produces an increase in plate current. This increase results, by feedback, in grid action which produces a still further increase in plate current, and so on, until the maximum current is reached. Then nothing can increase the current further, but the first slight irregularity in electron emission, voltage supply or other circumstance that can produce a tiny decline in plate current will start the whole process going in reverse direction. Plate current then declines until a minimum is reached. The next small

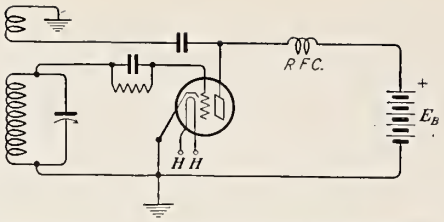


FIGURE 1. ***Armstrong tuned-grid shunt-fed oscillator.***

increase in current starts a new cycle of the same events.

Regardless of explanations, however, it is a fact that if any amplifying system is provided with feedback in sufficient volume and proper phase relationship, that system will always oscillate—generate a. c.

In public address work if too much loudspeaker sound is allowed to get back to the microphone the system will oscillate—become a generator of some one frequency of audio a. c.—and a continuous howl or squeal or whistle will be the only sound heard. This tendency of public address systems to oscillate because of acoustic feedback has resulted in the development of directional microphones, and in a strong trend toward using highly directional speaker baffles.

Ordinary amplifiers as used in the theatre commonly contain decoupling resistors and condensers. Their presence often has been pointed out when amplifier circuits were analyzed in detail in these pages. They exist to prevent feedback of output power through the common B supply, which, if it occurred, would tend to make the amplifier stop amplifying and act instead like a multitube oscillator.

The common carbon microphone used in every telephone is an amplifier, deriving energy for that purpose from the d. c. microphone current. It is not a very good amplifier, but before tubes were developed carbon microphones were used to amplify speech in long distance telephone lines. A combination telephone receiver and carbon mike was so constructed that the receiver, instead of creating sound, caused the diaphragm of a microphone to vibrate. This device was inserted in the long lines at suitable intervals. Now, since the carbon microphone is an amplifier, every telephone line ought to act as an oscillating circuit if output sound is fed back to the input with sufficient volume.

In phones of old-fashioned construction the receiver can be placed against the mouthpiece, and everyone knows that when that is done the system "sings." Move the receiver slowly away from the mouthpiece, and the effect is exactly the same as when the angle between coils of an inductive feedback circuit is increased—the system then stops singing.

In an ordinary three-element amplifying tube, the amount of amplification that can be utilized is limited by the fact that grid and plate behave like a condenser—they are two conductors separated by insulation (the insulation of the vacuum) and, therefore, they are a condenser. Alternating components in the plate current can be fed back, through that condenser, from plate to grid. The gridplate capacitance being extremely small, not too much power gets back that way. But if the loss in feedback is less than the gain in amplification the system will oscillate; therefore, even though not much power is fed back, if the amplification is very high breakdown into oscillation becomes probable. For high gain per tube it is customary to use a screen grid tube; the screen, interposed between control grid and plate, prevents plate-to-grid feedback.

To sum up and repeat—in any amplifying system supplied with d. c., if some of the output power gets back to the input in sufficient volume and in suitable phase, the system will oscillate or generate a. c., and an a. c. output can be drawn from it.

The frequency of the a. c. thus generated will depend on circuit factors, and particularly on the inductance and capacitance associated with the tube circuits.

Some Basic Circuits

One of the simplest of all oscillator circuits is shown in Figure 1, where feedback betwen plate and grid is effected by the transformer action of the two coils shown at the left. If the coupling between these coils is "loosened" by moving them to a distance from each other, or by placing them at an angle to each other, the system will stop oscillating.

To trace the circuits briefly: filament current is supplied to tube terminals H.H. Plate supply is derived from the B battery at the right: trace from positive up and left to the radio frequency choke coil (which keeps the a.c. generated out of the B battery), down through the tube to cathode, down and left to the negative side of the battery.

No grid bias is applied to the tube. When it is not oscillating, its grid bias is zero. When it is oscillating, however, the grid swings alternately positive and negative as the result of the a.c. produced by the oscillation of the circuit.

When it is positive it attracts electrons. These electrons complete their circuit back to cathode as follows: left through the grid leak, down through the grid coil, and right up to cathode. But the values (the "time constant") of the grid leak and its associated condenser may be so chosen, may be made so high, that the current through the grid leak will be extremely small, and all the electrons will

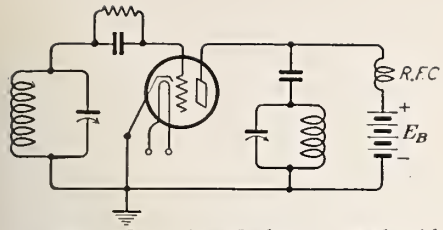


FIGURE 2. ***Tuned-plate tuned-grid shunt-fed oscillator.***

not have gotten off the grid before a new a.c. swing to positive attracts a new supply. Hence, there may be a permanent d.c. component in the voltage of the grid, and that d.c. component will be negative, while at the same time there is also an a.c. component on the grid that will be both negative and positive alternately.

The frequency of oscillation will depend on the inductance of the grid coil and the capacitance of the grid condenser. That condenser, it will be noted, is variable—capable of being adjusted or "tuned" to alter the frequency generated. That frequency will vary according to the following formula: $\frac{1}{2\text{pi}} \sqrt{\frac{1}{LC}}$, where L is the inductance of the grid coil and C is the capacitance to which the variable condenser has been tuned.

In Figure 1 it is the grid circuit that is tuned; but if the variable condenser were associated with the plate coil instead of the grid coil, tuning would be effected instead by the plate circuit inductance and capacitance, the formula remaining as above but L and C applying to plate circuit elements instead of grid circuit elements.

Both plate and grid circuits are tuned in Figure 2, and there is no inductive feedback. Feedback takes place through the grid-plate capacitance of the tube. Under these conditions oscillation occurs only when the plate and grid circuits are tuned to very nearly the same frequency. Set them to different frequencies by detuning either one, and oscillation stops.

Two Popular Oscillators

Figures 3 and 4, respectively, are the Hartley and Colpitts oscillator circuits, two of the most popular and most widely used. In the Hartley oscillator (Figure 3), feedback is effected through the autotransformer coil at the left of the diagram, that coil being paralleled by a variable condenser through which frequency is adjusted. In the Colpitts (Figure 4), feedback is capacitative, through condensers. Two of these condensers are shunted by a variable inductance, coil L, through which tuning is effected.

In some cases the tuned circuits associated with the grid of Figure 2 are replaced by a quartz crystal. Such a crystal will vibrate, physically, when an alternating voltage is connected across it, but it will vibrate at only one frequency. Its physical size and structure determine its resonant frequency. Therefore, the crystal is "tuned," permanently, by being ground to size in the course of manufacture.

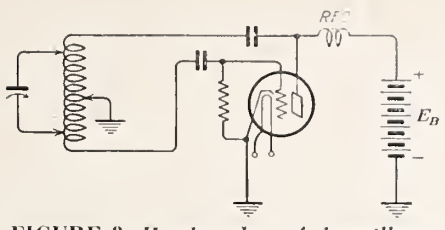


FIGURE 3. ***Hartley shunt-fed oscillator.***

Oscillators using crystals are called crystal-controlled. Their frequency of oscillation cannot vary, except as the crystal may expand or contract with changes of temperature. When even this small "drift" in frequency is objectionable, the crystal is mounted in a constant-temperature enclosure. A heating element and a thermostat provide a pre-determined, never-changing "climate."

In all the above circuits, the diagrams show only means for converting d.c. to a.c. No diagram includes any provision for connections through which the a.c. thus generated can be drawn from the oscillator and put to use. Commonly, this is done by connecting to the plate circuit. However, the impedance of any load coupled to a tuned circuit acts to alter the tuning, or frequency, of that circuit. If the impedance of the load changes, the frequency of the oscillator output may change, which is usually very undesirable.

Figure 5 shows the basic circuit of an electron-coupled oscillator, the frequency of which is independent of output load impedance. In Figure 5 feedback does not take place between plate and grid, but between screen grid and control grid, through the coil at the left of the drawing, which is wired as an autotransformer.

From the screen grid trace down through a condenser to the ground bus, left to the lower end of the coil, up through the coil to the tap connection, and right to cathode. This is the screen grid circuit. From the control grid trace up and left through the grid leak and grid condenser, down through the coil to the tap connection, and right to cathode. That is the control grid circuit, and the two are coupled inductively. The circuit is extremely similar to the Hartley, Figure 3, with the exception that the control grid of Figure 5 takes the place of the plate of Figure 3.

In the electron-coupled oscillator, therefore, screen grid, control grid and cathode take the part of the three elements of an oscillator triode, and produce a.c. But the plate, as the drawing shows, is at a higher positive potential than the screen grid. From the oscillatory electron flow within the tube a certain number of electrons will be drawn through the screen grid and to the plate. The plate is thus "electron-coupled" to the oscillatory electron stream of the tube's vacuum, and the plate current will include an a.c. component at the frequency generated. The plate, however, takes no part in the generating action, and the frequency produced will not be changed by an impedance that may be connected to the plate.

The fact that the plate circuit of Figure 5 contains tuning elements, a coil and a variable condenser, should not be misunderstood in this connection. The plate circuit is tuned so that it can accept, with maximum efficiency, the a.c. generated by the other three elements. If this were not done, the plate circuit would constitute a band-stop filter, and though the tube would continue to generate oscillations, the plate circuit might not be able to accept them.

Sawtooth Wave Oscillators

All these oscillator circuits, and many others that cannot be described in this brief introduction, develop essentially sinusoidal a.c., in which voltage and current rise and fall, and reverse direction, in a smooth, sweeping pattern as shown in Figure 6. For television, however, it is necessary in certain parts of the equipment to have a.c. that behaves a little differently; that rises slowly and drops abruptly, or possesses a "sawtooth wave shape"—as shown in Figure 7.

One device used to produce sawtooth wave a.c. is a gas-filled triode. An essential element of its circuit is a condenser connected between plate and cathode. When plate voltage is applied to this tube it cannot appear at its maximum value on the plate the instant the switch is closed. A very small fraction of a second is needed to charge the condenser connected between plate and cathode. The voltage across the condenser rises swiftly

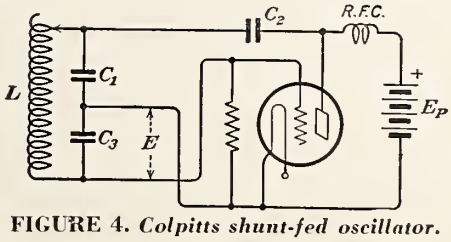


FIGURE 4. ***Colpitts shunt-fed oscillator.***

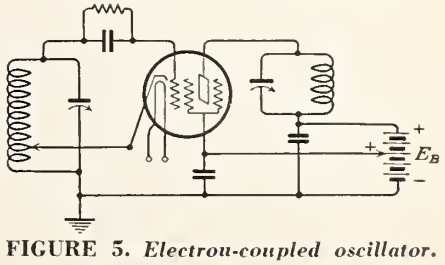


FIGURE 5. ***Electron-coupled oscillator.***

and steadily, as shown by the left-hand slope of the sawtooth waves of Figure 7. But when the voltage becomes great enough to ionize the gas in the triode, there is a sudden, enormous rush of plate current through the tube which effectively short-circuits and discharges the condenser, producing the right-hand slope of the sawtooth waves.

The rush of current through the tube pulls down the plate voltage to the point where ionization is extinguished, and the same cycle of events immediately repeats itself.

The frequency of such a circuit is not very critically controlled by the circuit elements themselves, therefore the oscillator is often used in association with a second tube, wired according to one of the circuits previously described. The a.c. output of the second tube is applied to the grid of the gas-filled triode, and, therefore, controls the frequency of the sawtooth output.

But it is not even necessary to use a triode. An ordinary neon lamp can be made to oscillate in the same way. The description of the action of a gas-filled triode oscillator, just given, will apply to a neon oscillator. Where the above description refers to "plate and cathode" substitute "the two electrodes of the neon tube." The frequency generated by the neon tube similarly can be controlled by a sine wave frequency derived from a Hartley or Colpitts, or other sinusoidal oscillator. This frequency is introduced in series with the d.c. voltage ("plate" voltage) applied across the neon lamp.

Another circuit popular with television designers is the multivibrator diagrammed in Figure 8. The output wave shape resembles, but is usually not identical with, Figure 7. The output can be taken from the a.c. voltage drop across any of the circuit elements. Either tube may, therefore, be considered the output tube, according to where the output circuit is connected.

Suppose the two condensers to be numbered, from left to right, C_1 and C_2 and the two horizontal (plate) resistors to be numbered from left to right, R_1 and R_2. Then the output frequency is approximately equal to $1/(R_1C_1 - R_2C_2)$. But operation is unstable as to frequency, and can readily be controlled by the frequency of a suitable sine wave introduced into the system.

Oscillators such as the last three mentioned are called relaxation oscillators. The a.c. wave shapes that can be obtained

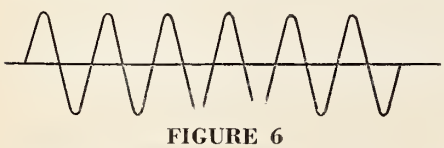


FIGURE 6



FIGURE 7

from relaxation oscillators and associated circuits are astonishing in their variety, and include sawtooth waves, square top waves, and, in fact, waves of almost any configuration the television engineer may need.

Some Oscillator Troubles

Tubes used as oscillators are subject to all the usual troubles of possible filament burn-out, deterioration of emission with age, loss of vacuum (gassiness) and so on. Applied voltages must be of correct value, and the circuits supplying the tube voltages are all subject to the usual troubles, just as in amplifiers.

In addition, an oscillator circuit will not function, as explained, if it depends on feedback coupling and the coupling is "loosened." Coupling effected inductively, by means of coils, can be loosened if the spacing between the coils is increased or the angle between them made wider. Capacitative coupling is loosened if the capacitance of the condenser declines, which may occur through deterioration of a fixed condenser or improper setting of a variable condenser. Capacitative feedback also depends very materially on frequency, since high frequencies pass through a capacitance more easily than low ones. Thus the inter-electrode capacitance in a three-element tube does not cause feedback in audio or voice frequency amplifiers as readily as in radio frequency amplifiers.

If the oscillator circuit includes a grid leak condenser (Figure 2, for example) failure in those parts may prevent the tube from oscillating.

Also, an oscillator is expected to deliver a.c. at the desired frequency and

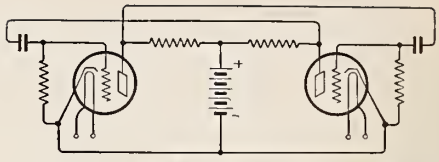


FIGURE 8. *Multi-vibrator oscillator.*

with the desired wave-shape. Any change at all in the circuit elements may change frequency, wave shape, or both. If a repair is made, and the new wire is run a little differently from the one it replaces, a change in output frequency can be expected. This change will be of little importance if the oscillator is working at lower frequencies, say up to 100,000 cycles; in the higher frequencies up to millions and billions of cycles per second a slight change in the length or position of one wire may upside the oscillator completely, resulting in a very different output frequency from the one intended. The reason is that in many oscillators capacitance and inductance control the frequency of the output; at very high frequencies, as used in television, extremely little capacitance and inductance are required; and the capacitance and inductance of a short piece of straight wire can become decidedly important.

In the case of very high frequency oscillators, tubes of the same type but different makes may not be quite as readily interchangeable as are amplifier tubes. Tube characteristics that are insignificant in audio amplification become vital at very high frequencies—inter-electrode capacitances, for example. In some case it may be necessary to re-tune the circuit somewhat even when replacing one tube with another of the same make, although manufacturers make every effort to standardize those of their tubes that they recommend for very high frequency work. But in circuits where capacitance is important down to the last few micro-micro farads standardization becomes difficult,

(*Continued on page* 24)

International Projectionist

extends to all its subscribers

the

Season's Greetings

Season's Greetings



INTERNATIONAL ALLIANCE OF THEATRICAL STAGE EMPLOYES AND MOVING PICTURE MACHINE OPERATORS OF THE UNITED STATES AND CANADA

RICHARD F. WALSH, *International President*

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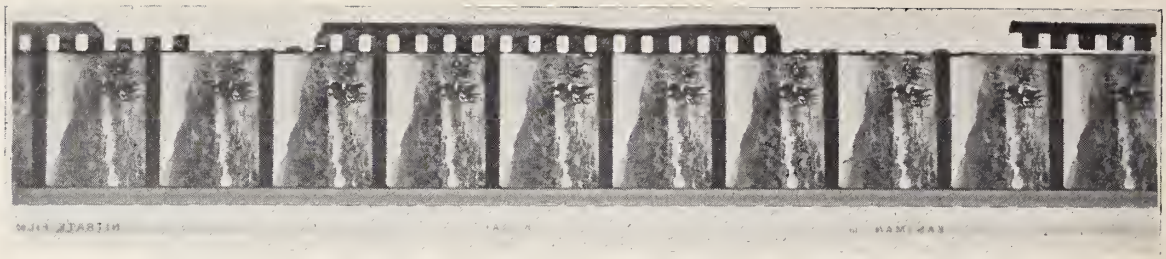


FIGURE 12. *An example of edge damage on positive motion picture film.*

THE PROJECTION LIFE OF FILM†

PART II

Edge Damage

By *R. H. TALBOT*
EASTMAN KODAK COMPANY

All too frequently a print is received by the exchange directly from a theatre with torn edges, or in some instances with one row of perforations entirely missing from some sections. How can this be? In some cases the print has been so badly damaged that projection in this condition would have been impossible. Yet the theatre had made no complaint nor had they asked for another print. We must assume, therefore, that the print operated satisfactorily. Likewise, the reverse is true.

Prints have been received by the theatre directly from the exchange with the edges broken to the extent that several sections (2 to 3 ft. in length) had to be removed before the roll could be projected again, and yet this print had been inspected carefully at the exchange and the inspector's seal affixed thereto. There is a preponderance of evidence to the effect that most of the damage occurred between the theatre and the exchange.

The writer is aware that a certain amount of edge damage is caused by the film coming into contact with the sharp surfaces of defective reels—a condition brought about largely by the scarcity of new metal reels at this time. He is also aware that in certain rare cases, which each one of us can recall, the edges of the print have been damaged as a result of what we may call an accident, *i. e.*, the reel of film may have been dropped, the metal shipping case may have been dented or crushed, or the film may have jumped a sprocket at a splice. But let us not, in recalling some of these instances, assume that the major amount of edge damage comes from these causes. It is far too prevalent.

There is another observation which is very pertinent to this matter of edge damage, *i. e.*, the damage is confined largely to prints which have been in use long enough to become oily. It is very difficult to wind a smooth firm roll on a hand rewind when reels, which are wider than the film—and often misshappen—are used.

Uneven winding leaves the edges of certain convolutions protruding farther than those immediately adjacent. If the roll is not wound too tightly, and if the film is not oily, these protruding edges will slip back into place by pressure from the reel flanges. If the film is oily, however, a firm bond is formed between successive layers within the roll so that the protruding edges of an unevenly wound roll cannot slip back into place. When pressure is brought against these edges by the reel flanges during shipment, or even by careless handling, they will be damaged and, in some cases, even broken off completely, as shown in Figure 12.

Basically, the solution of this problem would be to ensure that all rolls are evenly wound and that no oil is allowed to get on the film. This would not be very practical, for both of these conditions will probably prevail for some time to come.

Methods of Protection

This problem of edge damage can be attacked from 2 angles: (1) *by providing protection for those edges of film which protrude;* (2) *by surface-treating the film in such a manner that the protruding edges of film, even when oily, will telescope back into the roll without damage.*

The first of these two methods, protection of the protruding edges, was discussed in a paper read at a meeting of the Society.[1] This proposed solution concerns the use of a white plastic band to replace the paper wrapper on exchange reels. The band which was described was approximately 0.040 in. thick and 3/16 in. wider than the film. The greater width of the band, together with its stiffness, prevents to a large degree the bending over of the protruding edges of the film by the reel flanges.

A test was made to demonstrate the effectiveness of this type of band for the prevention of edge damage. Three 2000-ft. rolls of processed positive motion picture film were spotted with oil throughout their entire length. Each roll was then projected 10 times in order to "bake" the

† *J. Soc. Mot. Pic. Eng., Aug.* 1945.

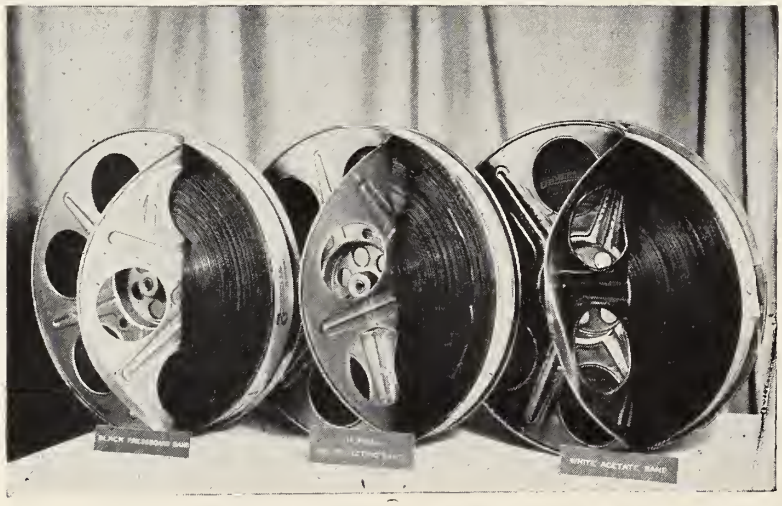


FIGURE 13. *Comparative edge condition of film protected by stiff bands (not shown in picture) with edge condition of film wrapped with customary paper band.*



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Holiday Greetings



CHICAGO MOVING PICTURE MACHINE OPERATORS' UNION, LOCAL NO. 110

of the

I. A. T. S. E. and M. P. M. O.

of the

UNITED STATES and CANADA

oil into the film. The rolls were then mounted on 3 identical exchange reels, using a constant-tension winding mechanism. In the mounting of these rolls the film was forced first against one flange and then against the opposite flange in order to produce protruding edges.

Around one roll was placed the conventional paper wrapper or band. Around another roll was placed the white plastic band. Around the third roll was placed a similar stiff band which instead of being plastic, was made of black pressboard. These reels of film were then placed in a 3-reel shipping case and given a handling test to simulate the abuse many cases of film undergo in shipment. The positions of the reels in the case were changed from time to time.

At the end of the test, the bands were removed and the reel flanges bent back so that the extent of edge damage could be seen. The result of the test is shown in Figure 13. It can be seen that there is some edge damage on the 2 rolls protected by the stiff bands, probably as a result of the severity of the treatment, but the edge damage on the roll covered by the paper wrapper is considerably greater. It is believed that by this simple expedient a large percentage of the edge damage to prints can be prevented.

Surface Treatment

The second method of attack, surface treatment, has been the subject of numerous investigations,[2] over a period of many years, often leading to patented processes. The principal objection to most of the existing processes lies in their inability to satisfy all the requirements of the ideal surface treatment at the same time. It is believed that an ideal surface treatment should accomplish the following:

(1) *Provide a smooth coating of high gloss which will minimize the mottle on the screen from oil spots on the film.*

(2) *Give projection runs equal to or surpassing film having a liberal appplication of paraffin wax along the perforated area.*

(3) *Minimize or eliminate the edge damage previously mentioned by providing a slippery surface even when the print is oily. The rating of films for their ability to telescope when oily will be referred to hereafter as their "oily slip."*

(4) *Provide protection from surface abrasion.*

Since it is believed that no commercially available surface treatment satisfies all these requirements, a study is now being made of the problem. The data to be presented and the conclusions to be drawn are in the nature of a progress report. The scope of the problem and its complexity preclude a final answer at this time.

A large number of waxes were examined, for their solubility characteristics and their general appearance when applied to the surfaces of film in any reasonable concentration. Various concentrations of these waxes in carbon tetrachloride were applied to the entire emulsion surface of positive films by the plush-wick method on a machine designed for this purpose.

TABLE I.

Waxes judged most suitable for surface lubrication of motion picture positive film. For purposes of comparison, the samples were given an alphabetical rating for oily slip and scratch resistance—"A" representing the ideal.

Wax	Max. Useful Per Cent Conc. in CCl_4	Wear Life as Per Cent of Edge-Wax Check	Oily Slip	Scratch Resistance
Aristowax	0.06	73	D	C
Cantol	0.125	71	E	C
Pentawax 217	0.125	80	E	D
Glyco dilaurate	0.25	41	E	B
Johnson's WM 169C	0.125	59	B	B
Gelowax	0.06	46	E	C
Glycoride	0.06	46	E	C
Pentaerythritol tetra stearate	0.06	56	E	C
Candelilla	0.09	50	E	B
Santowax R	0.09	41	C	C
Ceresin	0.125	70	E	C
Ozokerite	0.125	88	C—	C
Synthowax	0.20	123	D	C
Betanol 107	0.25	61	C+	B
Betanol 114	0.125	95	C—	B+
Betanol 152	...	56	C—	C
Carnube	0.125	45	D	B
Pentaerythritol diacetal	0.25	44	C—	D
Pentaerythritol di-N-butyral	0.25	51	C+	D
Dioctadecyl carbonate	0.125	55	D	B
Johnson's WM 169C (Repeat Test)	0.125	80	B	B
Johnson's WM (Both Sides)	0.125	129	B	B
Eastman Edge Wax (Perforated Area Only)	3.5	100	D	D

Only the waxes shown in Table I were considered worthy of further testing. One thousand-ft. rolls of film were coated with each wax from the concentrations in carbon tetrachloride indicated, and examined for appearance, wearing quality, oily slip, and scratch resistance. Note how low the concentrations of wax must be to give a surface coating of good appearance. Most wax applications in these low concentrations give only approximately one-half the wear life of edge-waxed film.

In the oily-slip test, at least 900 ft. of each sample roll was liberally spotted with machine oil throughout its entire length and then projected 10 times on a representative theatre projector to bake the oil into the film. Apparently, many waxes, together with oil, yield a grease-like composition which causes the layers of film to adhere together, since in many cases the lubricated films have a lower rating on the oily-slip test than untreated films.

Of the waxes examined thus far, only one seemed to be outstanding in respect to the telescoping of an oily roll—Johnson's Industrial Wax *WM-169-B*. For some reason, the waxes used in this mixture give a smooth, glossy coating which imparts a slip to the film layers even when the film is oily. In the first test,

(*Continued on page 26*)

Season's Greetings

LOCAL NO. 182, I. A. T. S. E.

BOSTON, MASS.



Antennas 6 miles aloft blanket nation with television, FM. Key to Westinghouse Stratovision is airplane operation. Reason is that the radio waves which carry these services do not travel beyond the horizon as do those of standard-band radio. This means that television and FM programs are available only in a direct line from their transmitters.

Pictured here is a ground station with its coverage radius of about 50 miles indicated by the small circle. Large circle shows how coverage is increased when programs from the same ground station are "beamed" to an airplane flying at 30,000 feet and broadcast from that altitude. Large circle covers about 103,000 square miles lying within a radius of 211 miles.

The Stratovision System for Television, FM

By *C. E. NOBLES*

INDUSTRIAL ELECTRONICS DIV., WESTINGHOUSE ELECTRIC CORP.

ALTHOUGH television has been developed to a technical degree that allows the broadcasting of good pictures over short distances, and although it is possible to broadcast a picture which is very good, even in full color, several sizeable stumbling blocks must be hurdled before it is possible to realize a national television coverage approximating present-day standard broadcasting coverages. By telecasting from airplanes cruising 30,000 feet above the earth, most of these problems can be overcome.

Television and frequency modulation broadcast waves arrive at receivers in a manner different from the way standard and international short waves arrive at receivers. Unfortunately for television and frequency modulation, this results in a limitation of the range possible for these services.

In standard broadcasting and short-wave broadcasting, the signal at a receiver is composed of a "ground wave" which follows the earth's curvature and a "sky wave." At the relatively low frequencies used for these types of broadcasting the ground wave bends in such a way as to follow the earth's curvature. Also, at these low frequencies, a highly ionized layer, called the Heaviside layer, which is about 100 miles above the earth's surface, reflects the "sky wave" and sends it back to the earth's surface. It can be seen that the receiving antenna may be far below the horizon with respect to the transmitter and still receive both ground and sky wave signals.

"Line-of-Sight" Problem

In ultra-high frequency broadcasting, involving very high frequencies, the "ground wave" does not curve appreciably to follow the earth's curvature nor does the Heaviside layer bend the sky wave back toward the earth.

This means that a receiving antenna located below the horizon from the transmitting antenna receives no signal either from the ground wave or the sky wave. When the receiver is within line-of-sight distance to the transmitter, however, it receives a "directly transmitted wave" and a "ground reflected wave" from the transmitter. Television and FM broadcasting are, therefore, limited to "line-of-sight" distances.

These two waves—the direct wave and the ground-reflected wave—tend to cancel each other at the receiver. If they traveled over identical path lengths they would cancel each other and no signal would be heard at the receiver. The receiver gets its signal by virtue of the fact that the paths traveled by the direct wave and the reflected wave are different.

Generally speaking, anything we can do to increase this path difference will result in a greater signal at the receiver.

Line-of-sight distances between the transmitting and receiving antennas may be increased by raising the height of either antenna. It would be economically impractical to raise thousands of receiving antennas, but the transmitting antenna can be raised to take advantage of an increased distance to the horizon. Many FM and television broadcasters are planning to locate their transmitters and transmitting antennas on tall buildings or high hills in order that their service areas may be increased.

The Stratovision system for broadcasting television and FM programs was originated by C. E. Nobles, 27-year-old Westinghouse engineer and was further developed by the Westinghouse Electric Corp. in cooperation with the Glenn L. Martin Co., pioneer aircraft designers and builders. The accompanying article by the brilliant young originator of Stratovision describes in detail the underlying reasons for the development of the system and includes detailed information as to its operation, including notes on plane design and consideration of weather as an operations factor. Highly competent engineers hold that the Stratovision system is not only wholly feasible but in the present state of the transmitting art offers the most promising method for the speedy attainment of the goal of network transmission of television.

The average service radius of high-powered television and FM stations with fortunate antenna locations is about 50 miles. At the present state of the art, because of very difficult tube problems at high frequencies and wide band widths, there is no very satsifactory way of obtaining the radio frequency power required to cover a service radius of even 50 miles. This is especially true of the higher frequency, high-definition color television. At the present time color television powers of the order of five kilowatts can be developed, whereas about 50 kilowatts will be required to properly serve a 50-mile radius from, say, the Chrysler Building in New York City.

Present Range Restricted

Because any television transmitter has a range which is relatively small and because the cost of producing a television program which will hold an audience's attention is very high, it becomes necessary to distribute a program to a good many transmitters so that the program cost may be distributed over a great number of listeners. It is anticipated that there will be two main television programming centers located in Hollywood and New York City, where shows will be originated and fed into a network of television broadcasting stations all over the country. This is an arrangement much similar to the present broadcast network set-up.

The distribution of standard broadcast programs to the various broadcasters is a very simple process compared with the nationwide distribution of television programs. Existing telephone lines are inadequate because of the bandwidth required to transmit a television program.

Two methods are being used to distribute television programs, namely coaxial cables and radio relay stations.

Coaxial cables have been installed and used to distribute television programs. Published information indicates that by approximately 1950 it is intended to complete a cross-country link from Boston to San Francisco and make it available for the distribution of television programs to television broadcasters. These cables at the present time will not transmit the definition required by black-and-white television standards and are very much inadequate for high-definition color television.

The construction cost alone for laying this cable is about $3 per foot, thus the proposed route will cost approximately $100,000,000.

Relay-Link Needs 100 Towers

The other approach to the program distribution problem is a series of radio relay stations which use highly directional radio for relaying the program from one point to another. A typical installation in a relay-link chain consists of a tower approximately 300 feet high with a receiver to receive the program from one tower and a transmitter to relay the program to the next successive tower in the chain. Because of the line-of-sight characteristics of the frequencies involved in this relaying, relay towers will be located approximately 35 miles apart. This means that 100 relay towers would be required to get a program tie-up from New York to Hollywood.

Such a system of relay stations is now in operation connecting Washington, Philadelphia, New York and Schenectady. Plans have been published to install and operate a chain of relay stations which will network the country.

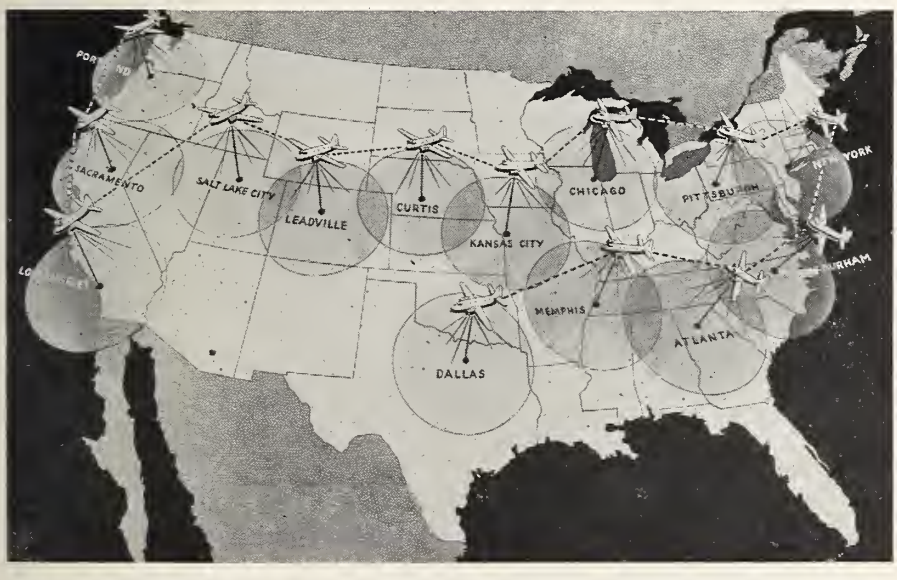
Either of these systems—coaxial or radio relays—has the disadvantage that large quantities of expensive equipment are necessary to distribute the program, and that any city desiring a network tie-in must bear the added expense of cable or radio relay connections to the main route.

The operation of relay or cable networks presents very sizeable technical problems because of the number of times the program must be handled. At each relay station additional distortions are added to the picture in the form of noise, phase distortion, and amplitude distortion. Unfortunately the resulting picture degradation increases very greatly as the program is handled more and more times.

This means that a very good picture might be put into a network at New York, and gradually become worse until it arrives at Hollywood almost completely unrecognizable. The size of this technical problem is such that it is doubtful if a "good" picture will not be transmitted from New York to Hollywood by this system for many years to come.

A great many of all of the aforementioned difficulties, both in broadcasting and program distribution, could be eliminated if a greater service range could be had from a television station and if relaying stations did not have to be so close together.

It is obvious that if one station had sufficient broadcast range to cover the nation, there would be no necessity for relaying and that if broadcasting stations had smaller service areas, there would be need for more relaying. It is axiomatic, therefore, that the service area covered by a broadcast station and the amount of relaying necessary to give nationwide television are inversely related.



Geographical coverage plotted for Stratovision system. Programs for the system would be originated in ground studios and "beamed" (solid lines), as in military radar, to planes for broadcast. Similarly "beamed" plane-to-plane connections (dotted lines) would form a nationwide network. Each plane would receive and broadcast 9 simultaneously available programs throughout a 103,000-square-mile area within its 422-mile line-of-sight diameter (shaded circles).

Broadcast locations shown would provide coverage for 78% of the nation's population; 100% coverage merely would require more airplanes.

Airborne Transmitters

It is technically possible to realize relatively enormous service coverage for television and FM broadcast transmitters and at the same time increase radio relay spacings enormously by departing from past broadcast practices.

If a television transmitter were placed in an airplane and the television program broadcast from the airplane in flight, the transmitter's coverage area would be increased by virtue of an increased line-of-sight distance to the horizon. At an altitude of 2,000 feet, a

(*Continued on page* 34)

IN THE SPOTLIGHT



By *HARRY SHERMAN*

THE ENEMIES of freedom have been defeated and the work on reconstruction has begun. Unfortunately, however, there are still clouds of hatred in many spots of the globe. Here in our own midst there are disagreements and misunderstandings. Yet, when we consider overall the many things for which we should be thankful, we are spurred on in our efforts to find a solution to end the many evils that still beset this war-torn and weary world of today. This is our first peacetime Christmas since 1940, and it is our fervent hope and prayer that it is the beginning of a new era of "peace and goodwill towards all mankind."

● Frank Dowd, secretary of Local No. 170, Kansas City, Mo., recently underwent a serious operation. We are sure his many friends in the Alliance will be glad to learn that he is making steady progress on the road back to health. We'll be looking for you at the next I. A. convention, Frank.

● In the November 2, 1945, edition of the New York Daily Mirror, Walter Winchell, the famous columnist, reported: "This is how the Broadway movie theatres welcomed the fleet on Navy Day—THEY RAISED PRICES!"

And these are the theatres that fought —unsuccessfully, we are happy to state—against increasing the salaries of their projectionists in recent negotiations with Local No. 306. Yes, sir, flag waving with one hand while the other greedily grabs the shekels.

● The only woman member of the I. A. executive board, 9th vice-president Louise Wright, who is also business agent for Local B-53, Dallas, Texas, fancies herself somewhat of a blues singer in her leisure moments. We heard her render the "St. Louis Blues" at an I. A. gathering several months ago, and while we don't think that Ethel Merman or any of the other famous stage and radio singing stars need worry about competition from Louise, she did put the number over very nicely.

● We recently paid a visit to Charlie Brunner, secretary of Local No. 130, Altoona, Penna., who suffered a leg amputation several months ago. Charlie certainly has what it takes, and is determined to be up and around again by Christmas. Knowing something about the man's guts, we are betting on him.

● The members of Syracuse Local No. 376 are now assured of vacations with pay. Contracts recently signed with theatres in the local's jurisdiction provide for vacations with pay for projectionists. Louis R. Boyd, president, and George Raaflaub, secretary, negotiated for the union.

● Pvt. Norman Waters, business agent on leave from Local No. 554, Lebanon, Penna., joined the ranks of benedicts last month while home on furlough when he married Miss Lillian Heisey. After a brief visit to the home of Albert Spayd, union secretary, the happy couple left for parts unknown for their honeymoon.

● "The Projectionists' Educational Club," formerly the Projection Society of Toronto Local No. 173, has embarked upon its new career as an educational organization to further a better understanding of common problems within the industry. Membership in this club is open to everybody in the motion picture industry in Toronto. Much of the groundwork in organizing the club has already been laid—a charter has been obtained, officers elected, and a constitution and by-laws formulated. More about this worthy organization and its ambitious program will be set forth in these pages in a future issue.

Arthur Milligan, president of Local No. 173 and of the former Projection Society, is one of the guiding lights of the new club. With such able leadership the success of the new Projectionists' Educational Club is a foregone conclusion. To this we add our very best wishes.

● We recently had occasion to tour much of the State of Pennsylvania and we visited many local unions—both large and small. We were quite surprised to learn from many local union officials we talked with of the reluctance of many circuits to grant vacations with pay to their projectionist employes. In these theatres all other employes—managers, ushers, ticket takers, cashiers, porters, etc.—are granted vacations with pay as a matter of fact but the projectionists, for some reason or other, do not seem to rate that consideration. On the other hand, contracts with independent exhibitors do provide for paid vacations for projectionists. You figure that out—we can't.

● For reasons of state the parties concerned shall remain anonymous. When a certain I. A. vice-president was called to New York to attend the recent I. A. Executive Board sessions, he decided to take his wife along with him. The lady was all agog and immediately began to plan her wardrobe for the trip. Lacking white gloves, she bought a pair of cheap fabric ones for $1.89 (the only white gloves available in her town), and was quite pleased with her purchase.

To show his appreciation of his wife's bargain, our v. p. thought that a suit to match the gloves would be in order. No sooner said than done—wifie hied herself down to her favorite shop, bought a

Greetings!

Moving Picture Machine Operators' Union

LOCAL NO. 650, I. A. T. S. E.

Westchester County **New York**

suit costing $76 to match the $1.89 gloves. But that was not all—a bag was needed to complete the outfit. She saw a bag in a shop window she thought would go nicely with her suit and gloves. However, when she was quoted $140 for the bag plus 20% tax, wifie decided to call it quits and went home minus a bag. Here is the payoff—when the gloves were washed they shrank to half the original size and now it seems that the v. p. has to start all over again.

Moral: From little acorns big oak trees grow.

● We have a great deal of admiration for a fellow who pulls himself up by his bootstraps, so to speak. Such a guy is I. A. representative John B. Fitzgerald, former business agent of Cleveland Local No. 27. John was left an orphan when he was but a tot and was raised in the Ohio Soldiers and Sailors Orphans Home in Xenia, Ohio. He left the orphanage when he was old enough to fend for himself and is today a shining example of a man who made the most of his opportunities. John is president of the Ex-Pupils Association of the Home, and is an elected member of its board of directors. He is highly regarded by his many friends and fellow workers and is, in a large measure, responsible for the fine shape Local 27 is in today.

● Although most daily newspapers throughout the country and a majority of the periodicals have increased their prices during the past few years on account of increased production costs, I. P., which was faced with the same problems, absorbed all increases and consistently maintained the same subscription rates for the past 15 years. However, a notice from our printer that beginning with this issue our printing costs would be increased another 20% (incidentally, the third in two years), makes us give serious thought to a change in our subscription rates. We cannot continue to absorb increased production costs and remain in existence, hence the obvious thing for us to do is to make a proper adjustment in our rates. This will come in due time—and soon.

● There will be big doings in the home of John F. O'Connor, Chicago Local No. 110, this Christmas, when Cadet Patrick J. O'Connor comes home on his first furlough since his appointment four years ago to the United States Military Academy, West Point, N. Y. Young O'Connor who is a member of the 1946 graduating class at West Point, is an apprentice of the Chicago Theatrical Protective Union Local No. 2, and his appointment to West Point was sponsored by the late Frank C. Olsen, business agent of the local. From advance reports, we gather that it will be the day of days for the O'Connor clan.

Holiday Greetings

from the Officers and Members of

HOUSTON LOCAL NO. 279

I. A. T. S. E.

E. J. Miller, ***Business Representative***

Notes from Schenectady Local 314:

● Robert Fonda is back at his old job at the Strand Theatre. He was inducted in the Army Air Corps in September, 1942, and in April, 1943, after completing a course in radio, he was released and sent to General Electric's Electronic Department, where he remained until his final release in September, 1945.

Patrick Smith's application for membership in Local 314 was held in abeyance during his enlistment with our Armed Forces. He was inducted in the Signal Corps April, 1942, and took part in the African and Italian campaigns. He received his Army discharge in September of this year and immediately thereafter was obligated in Local 314. He is now employed in the projection room of the Strand Theatre.

Thomas Keith, also of the projection crew at the Strand, is recuperating at his home from a serious operation. He is a veteran of World War I and has been with the theatre for the past 20 years. He expects to be back on the job January next.

● The request of Calgary, Canada, Local No. 302 officials' new contracts allowing for a 25% increase, double time for statutory holidays, and 12 days sick leave with pay is now before the Regional War Labor Board for settlement. The old contracts expired August 31, and any new agreements will be retroactive to September first. The members of Local 302 are now being paid time and one-half for all overtime over 33 hours; double time for all midnight previews, special shows and matinees, with a minimum of two hours for each call.

● Charlie Dentelbeck, supervisor of projection and sound for Famous Players in Canada, recently became a grandpappy for the fourth time. Getting to be a habit, isn't it, Charlie?

● Tom Canavan, of the St. Louis Canavans, and in charge of Altec's St. Louis branch office, has been elected an officer of the Variety Club.

● We were sorry to learn of the sudden death of Louis Lodge, Sr., old time member of Toronto Local No. 173. Lodge was a passenger on a street car which collided with an army truck. His son, Louis Lodge, Jr., was a former secretary of the local. We extend our deepest sympathies to the family.

● Another old-timer has passed on. Gar McFadden, secretary of Local No. 105, London, Ont., Canada, died last month. McFadden was 60 years old at the time of his death and had been employed at Loew's Theatre in London for many years.

● New York City Local No. 306 is now in the throes of its biennial election campaign. Nominees for all offices are busy electioneering and until election day the political dirt will be flying thick and fast. It is a hot campaign and political leaders

(*Continued on page* 33)

Holiday Greetings

from

Projectionists Local No. 376

SYRACUSE, N. Y.

Season's Greetings

1945 - 46

Projectionists Local No. 488

I. A. T. S. E.

HARRISBURG, PENNA.

Projectionists' Course on Basic Radio and Television

By *M. BERINSKY, E.E.*
MEMBER OF INSTITUTE OF RADIO ENGINEERS

XVIII—VACUUM TUBES

THE SUCCESS of modern radio depends more upon the vacuum tube than upon any other single device. It performs amazing operations with precision and economy; it can detect, amplify, rectify, and create electrical impulses. The vacuum tube has found wide application not only in radio but also in industrial control work. It can detect flaws in metals, grade materials, detect smoke, control machinery, and perform other functions too numerous to mention. The materials that go into the makeup of the radio tube come from every corner of the earth.

The vacuum tube has the ability to control the flight of millions of electrons almost instantly with a minimum of control energy. The tube controls these electrons so rapidly that it is capable of creating frequencies much higher than those obtainable with rotating machines.

Filaments and Cathodes

In the first article of this series we discussed the electron theory. We learned that all materials consist of atoms and that all atoms contain electrons. We learned also that the electron is a tiny particle of negative electricity that moves around the atom in an orbit resembling our solar system. Electrons can be made to leave the atom under certain conditions. Whichever method is used to liberate electrons, energy must always be used in the process.

In the vacuum tube, heat is the form of energy that is used for this purpose. If the temperature of a metal is raised by the addition of heat, the electrons in the metal will gain velocity. When the metal becomes hot enough to glow, some of the electrons will vibrate so rapidly that they will tend to break away from the surface of the metal. If the metal is enclosed in a partial vacuum, the rate at which the electrons leave the surface of the metal will be accelerated. This is the method used in most types of vacuum tubes in order to secure the necessary electron supply.

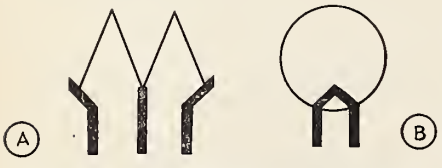


FIGURE 1. ***(a) Filament construction; (b) symbol for directly-heated filament.***

In a vacuum tube the device which supplies the electrons is called a filament or a cathode, depending upon the type of tube used. These electrons must be collected to be of any use. The electrode which collects these electrons is called a plate or anode. Any device which supplies electrons generally is called a cathode.

Heat is supplied to the cathode in order that it may emit electrons. The method for heating the cathode is used to distinguish between the different types of cathodes. A filament is known as a directly heated cathode, or filament-cathode. The filament-cathode is a wire that is heated when current flows through it. For example, if the filament of an electric bulb were used to supply electrons it would be known as a directly heated cathode. The filament of a tube causes it to emit light, but unlike the electric lamp, the emission of electrons and not of light is of the greatest importance in the tube.

The indirectly-heated cathode usually is simply called "cathode." This cathode consists of a filament, or heater, enclosed in a metal sleeve that has been coated on its outer surface with an electron-emitting material. The sleeve and its electron-emitting material is heated by radiation and conduction from the heater.

A filament, or directly-heated cathode, may be further identified by the type of filament or electron-emitting material that is employed. The materials that are commonly used are tungsten, thoriated-tungsten, and metals which have been coated with alkaline-earth oxides.

Tungsten filaments are made from the pure metal. Such filaments must operate at very high temperatures in order to emit a sufficient number of electrons. They require a large amount of filament power which means that their operating cost is high and their filament emission efficiency is low. Such filaments are very rugged and are found in transmitters and in high powered amplifiers.

Thoriated-tungsten filaments are made from tungsten impregnated with thoria. Because of the presence of thorium, these filaments will liberate electrons at lower temperatures (1700° C.) than pure tungsten filaments, and, therefore, will require less filament power and will be more economical than pure tungsten filaments.

Filaments which are coated with alkaline earths operate at about 700° C. and are the most efficient of the three types. They also are the most likely to be damaged by positive-ion bombardment and are not very rugged. These filaments are used for most radio receiver applications.

Directly-heated filament cathodes require relatively little heating power. Such tubes are widely used in battery operated receivers, because it is desirable that the power drain from the battery be as low as possible for reasons of economy. Some such types are the 1A7-GT, 1F5-G, 1H4-G, 1H5-G, 1T4, 1T5, 1S4, 1R5, and 31. Some a.c. operated types also have directly-heated filaments. These include the 2A3 and the 45. Figure 1 (a) shows a directly-heated filament cathode, and the symbol for the directly-heated filament cathode is shown in Figure 1 (b).

An indirectly-heated cathode, or heater-cathode, consists of a thin metal sleeve coated with electron-emitting material. The heater is placed within the sleeve and is insulated from it. The heater is made of tungsten or a tungsten-alloy wire and its only purpose is to heat the cath-

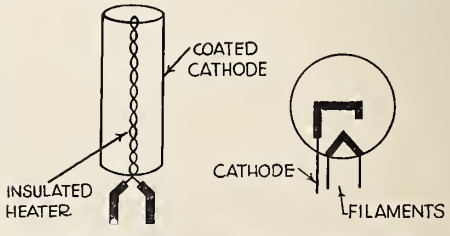


FIGURE 2. ***Cathode construction and radio symbol for a cathode (indirectly heated).***

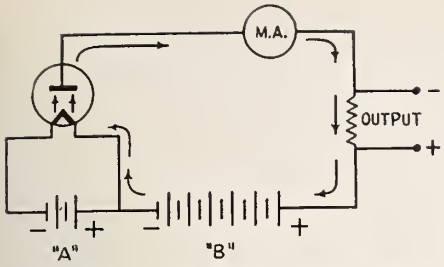


FIGURE 3. ***Edison effect. Current flows through tube when positive voltage is connected between plate and cathode.***

ode sleeve and sleeve coating to an electron-emitting temperature. It should be realized that useful emission does not take place from the heater wire in this type of cathode.

The heater-cathode type of construction has become very popular in recent years. Such tubes offer greater flexibility in circuit design, are not subject to as much electrical hum interference, have greater gain as amplifiers, and have better voltage regulation as rectifiers than directly-heated types. An indirectly-heated cathode is shown in Figure 2.

Diodes and Edison Effect

In the preceding paragraphs we discussed the methods for creating a large supply of electrons. These electrons are of no value to us unless we can collect them and put them to work. During the manufacturing process the air and other gases are removed from the tube. The connections from the tube elements are brought out through air-tight glass to metal seals. The removal of these gases allows freedom of movement of the electrons and prevents damage to the cathode. When the filament is heated to the proper temperature a cloud of electrons will appear in the vicinity of the emitting surface. These electrons have a negative charge. It will be remembered from previous articles that unlike charges attract and like charges repel.

In the course of his experiments during the latter part of the last century, Edison discovered that if he placed a metal plate inside of an electric lamp and connected a battery in series with this plate and one side of the filament, the positive terminal of the battery being connected to the plate, a current flowed through the lamp and continued through the external circuit. This circuit is illustrated in Figure 3.

At the time of his discovery, Edison was trying to find a way to prevent lamps from turning black after continued use. He was not much concerned about his discovery and merely mentioned it in his notes. Several years later Sir Ambrose Fleming, an English scientist, made use of this discovery in the development of the first practical vacuum tube. At the time is was called the Fleming Valve.

NOVEMBER QUESTIONS AND CORRECT ANSWERS

1. **(*Q*) A parallel circuit contains a 10-ohm resistor, an inductance reactance of 5 ohms, and a capacitive reactance of 20 ohms. The line voltage is 100 volts. Find the currents through the resistor coil, and condenser. Find the total line current.** ***(A) Current through resistor equals 10 amps.; current through coil equals 20 amps.; current through condenser equals 5 amps., and total current equals 18 amps.***

The theory on which this tube operated was known as the "Edison Effect."

At the present time the tube is known as a "diode" because it has two elements. This is the simplest type of radio tube and the patent, which described the tube as a rectifier of high frequency oscillations, and which was granted to Fleming in 1905, became one of the basic patents on vacuum tubes. Its functions in present day radio are those of detector or rectifier.

For an explanation of the diode let us refer back to Figure 3. When the cathode is heated a cloud of electrons fill the space directly above it. The plate is shown connected to the positive terminal of the battery. The electrons will be

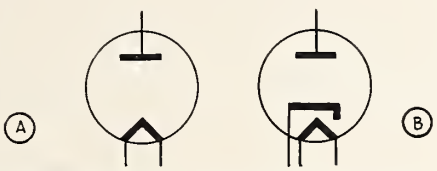


FIGURE 4. ***(a) Symbol for a diode tube using a directly-heated cathode; (b) symbol for a diode with an indirectly-heated cathode.***

attracted to the plate and will continue to flow through the external circuit consisting of a milli-ammeter, a resistor, and a large battery known as a "B" battery. The electrons will continue to flow through the circuit and will return to the cathode whence they came.

Because the electrons flow through the meter, it will indicate a current. This is known as the plate current. If the battery were disconnected, the meter reading would be zero, indicating that the current has stopped flowing. The reason is due to the fact that the positive potential which originally attracted the elecrons has been removed, and no further attraction exists. If the battery were reversed so that the negative terminal were connected to the plate and the positive terminal connected to one side of the filament, the current would still be zero. This is so because the plate would now have a negative potential with respect to the cathode, and since like charges repel, none of the electrons would be attracted to the plate and no current would flow through the external circuit. Figure 4 (a) shows the symbol for a diode tube containing a directly-heated cathode and Figure 4 (b) illustrates the same type of tube with an indirectly heated cathode.

The Diode as a Rectifier

We have learned that the diode type of vacuum tube will conduct current only when the plate is given a positive charge. This property makes the diode useful as a rectifier. A rectifier is a device which converts alternating current into direct current. This is necessary because tubes in radio receivers operate with direct currents on their elements, and the alternating current from the line must first be changed into direct current before it can be used in the receiver.

The circuit shown in Figure 5 illustrates how rectification takes place. A sine wave of alternating current is applied between the plate and the cathode. A resistor, known as a diode load resistor is connected in series with the cathode, the line voltage, and the plate. The rectified voltage appears across the load resistor, as may be seen in the illustration.

The input and output wave forms are also indicated in Figure 5. The output waveform is not a pure direct current, since such a current would appear as a straight line. A pure direct current could be obtained by the use of a filter circuit consisting of chokes and condensers. The direct current output voltage shown in Figure 5 is known as a pulsating direct current and could not be used in a radio receiver until it had been filtered sufficiently to resemble a purer form of direct current.

The rectified output resembles an alternating current except that the negative half-cycles are shown as being cut off. These negative half-cycles are not reproduced in the rectified output, but have been shown in the illustration by dotted lines. They are not reproduced because the diode will conduct current in only one direction: when the plate is positive.

When the plate is positive, the electrons from the cathode are attracted to it. These electrons flow through the load resistor and return to the cathode. The current which flows through the load resistor causes a voltage to appear across the resistor terminals. Since the electrons flow up through the resistor towards the cathode, the resistor terminal nearest to

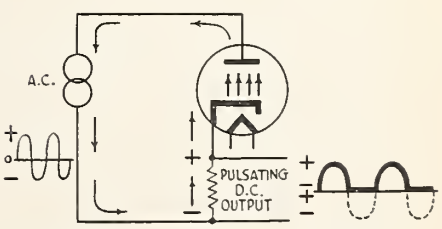


FIGURE 5. ***A diode tube acting as a rectifier of alternating current.***

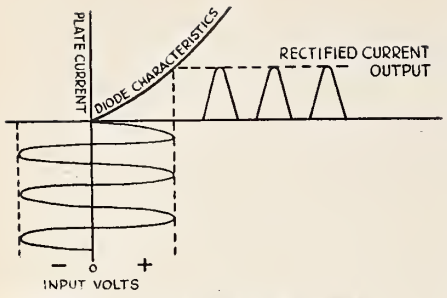


FIGURE 6. ***Characteristic curve of a diode rectifier.***

the cathode will be positive and the terminal furthest from it will be negative.

During the period when the negative half-cycle of the input voltage is applied to the plate of the diode, the electrons will be repelled away from the plate and back towards the cathode. Current will not flow through the tube during this period. Although it is possible to rectify alternating current by other methods, the vacuum has become most popular.

Figure 6 shows the characteristic curve of a diode rectifier. This diagram shows that the rectified plate current is zero during the negative half-cycle of input voltage, and varies between zero and some peak value during the positive half-cycle. The type of rectification that is illustrated in Figures 5 and 6 is known as half-wave rectification, because rectification takes place during one-half of the input cycle. The type 1-v and 12Z3 are of this form. These tubes have only one plate and one cathode.

Half-wave rectified direct current is difficult to filter and to change into a purer form of direct current, as is required for radio receivers. For this reason it is not as popular as another type of rectification known as full-wave rectification. Full-wave rectifiers contain two plates and one or two cathodes. The 80, 5T4, 5Y3-G, 5Z3, 25Z5, and 6H6 are of this type. The theory of full-wave rectifiers will be discussed in a later article.

Not all of the electrons emitted by the cathode reach the plate. Some of the electrons return to the cathode while others remain in the space between cathode and plate. These electrons form an

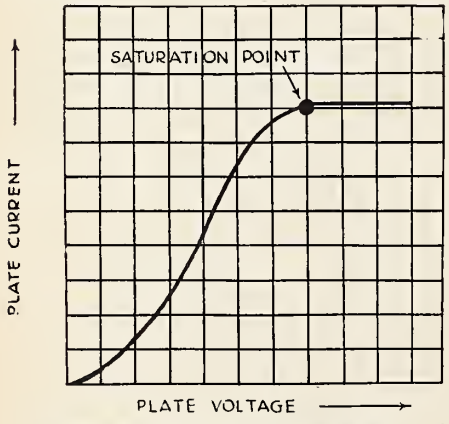


FIGURE 7. ***Emission characteristic of a diode showing saturation point.***

effect known as "space charge." Space-charge electrons have a repelling effect upon the electrons which normally leave the cathode; this effect tends to lower the amount of electrons reaching the plate.

The effect of space-charge is reduced and finally eliminated if the plate voltage is increased sufficiently to attract the space-charge electrons. This can be proved experimentally by increasing the positive voltage on the plate of the diode in the circuit shown in Figure 3. The plate current milli-ammeter will show an increase in plate current as the voltage is increased. The increase in plate current will occur despite the fact that the available number of electrons emitted from the cathode remains the same under all conditions in the experiment.

During the course of the experiment it will be seen that if the plate voltage is increased beyond a certain point the plate current remains the same for any further increase in plate voltage. This is due to the fact that all of the available electrons from the cathode are being attracted to the plate. This maximum current is known as the emission.

Tube testers which measure emission are very satisfactory for checking the condition of rectifier tubes. The emission of the tube being tested is compared with that of a perfect tube. If the emission of the tube being tested is more than a certain percentage below that of a perfect tube of the same type, the meter on the tube tester will read "bad." The emission characteristic of a diode tube is shown in Figure 7.

In practice, tubes are not operated so that they supply maximum current for any length of time. Such operation would cause the usefulness of the tube to deteriorate rapidly. If space-charge were not present to repel electrons coming from the cathode, it follows that the same plate current could be produced at a lower plate voltage.

If the distance between plate and cathode is made small the effects of space-charge will be minimized. This means is used in rectifier tubes such as the 83-v and the 25Z5, having heater-cathodes. In these types the radial distance between plate and cathods is about .02". If the distance is made small the voltage which the tube can withstand will be reduced, and a high voltage will arc over inside the tube. In special high voltage rectifier tubes the radial distance is about one-half inch or more. An example of such a tube is the 2X2.

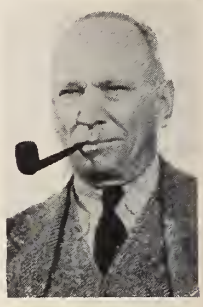
DECEMBER QUESTIONS

1. **Which type of cathode gives the most emission for the least amount of filament power?**
2. **Which types of cathodes are best suited for tubes that are designed for portable receivers?**

The answers to these questions will appear in the next issue.

Laboratory Established by General Precision

General Precision Laboratory, Inc., has been established to conduct centralized research for the General Precision Equipment Corporation and its subsidiaries, it is announced by Earle G. Hines, president. These subsidiaries include Ampro Corp., Askania Regulator Co., Cine Simplex Corp., the Hertner Electric Co., International Projector Corp., Librascope, Inc., J. E. McAuley Mfg. Co., Motion Picture Engineering Corp., National-Simplex-Bludworth, Inc., and the Strong Electric Corp.



Earle G. Hines

The laboratory company has contracted for the purchase of the Manville estate at Pleasantville, N. Y. Acquisition of this property follows a trend pioneered by the leading industrial organizations of the country to establish their research laboratories in a college-like atmosphere where creative thinking and fundamental developments can thrive to the best advantage.

Dr. R. L. Garman, director of research and development, will head the staff and direct its technical activities. Coordination of the laboratory's program with the operations of the manufacturing units located in some of the principal cities of the country will be conducted by H. Barnett, coordinator of research products of General Precision Equipment Corp. The staff of the laboratory will be composed of a score of physicists and engineers largely recruited from universities and war research laboratories.

Activities of the laboratory will be devoted chiefly to research and development in the fields of precision mechanics, optics, electronics, supersonics, hydraulics as they apply to motion picture, television, industrial process control and air-marine navigation equipment as well as fire control and other specialized equipment for the Army and Navy departments.

"VOICE OF THE THEATRE" SPEAKERS GET THEATRE TESTS

Altec Lansing Corporation, in discussing the availability of their "Voice of the Theatre" line of motion picture loudspeakers, has authorized the release of information to the effect that their new product received actual factual tests in large and small theatres for months before designs were completed. The theatre tests were conducted with the same secrecy that surrounded the company's war-time activities, it was pointed out.

Although the trade press was aware that these secret tests were being conducted in the Roxy, Paramount, and Radio City Music Hall theatres, in New York City, as well as in the Pantages Theatre, Hollywood, and in smaller theatres nearby, they withheld publication of this information because it was known that the new magnetic secrets embodied in these loudspeakers were also incorporated in military devices.

AT YOUR SERVICE

This department is a collection of random thoughts and some not so random: fact, fancy and opinion relating to the man behind the man behind the gun—the serviceman. The prime purpose of this section is to promote a closer relationship between serviceman and projectionist based on a better understanding of their mutual problems through an exchange of news and views, kinks and kicks. To this end, contributions relative to any phase of the serviceman's activities are invited.

How to Install 26936 Rubber Cushions On RCA Motors

When installing 26936 cushions on RCA motors, the job is simplified by installing the rubber detail without the outer metal ring. After the retaining wire is snapped into position, the outer ring is easily assembled if it is split open, at a slight angle, with a hack-saw. The motor cradle straps and screw will pull the ring together.—F. J. Pfeiff, *Altec.*

Eliminating Radio Interference

I discovered how to remove police radio interference from a Simplex "E" system in one of the theatres I service. A .1 mfd. condenser directly across the output terminals of the main amplifier completely removes the radio interference and it also reduces the effect of other disturbances, such as switch clicks and buzzer interference. It has no effect upon the frequency response.—S. Andresen, *Altec.*

Windex for Cleaning Up After Fires

Having experienced a number of projection room fires, I recommend "Windex" for cleaning the residue of burned film from sprockets, shafts, etc. I have found it to be more effective for this purpose than any other cleaning fluid. Windex is a blue liquid and may be purchased at any grocery store.—E. B. Miller, *Altec.*

Correction of Film Weave

Film weave due to an accumulation of foreign materials can be corrected in many instances by the following procedure. Dismantle pressure roller, dress the shaft with crocus cloth and replace it with a new spring or stretch it out to give more tension. Mix equal parts of carbona and Simplex oil and after lubricating the parts, re-assemble the unit.—Wm. Armstrong, *RCA.*

Threading Up Brenkert Projector

When threading up the Brenkert projector head, it is quite difficult to see whether the intermittent is in static position. At one of my theatres I painted a white mark on the red barrel aperture fan and a corresponding white mark on the center frame, inside of the projector head. This seems to be an ideal method of framing and is greatly appreciated by the projectionists.—S. S. Lebow, *RCA.*

Mounting of Volume Controls

Volume controls should never be mounted with their terminals up, for in time a certain amount of dust, etc., will gather around the terminals and cause the control to become noisy. Those mounted with their terminals down are not so apt to become noisy.—B. Savage, *RCA.*

Mounting for Low Frequency Baffle

Often during an installation, it is found necessary to provide some means to mount the low frequency baffles. I have found the following method an advantage over the platform as it is a single unit and is not so likely to be pushed off when moved.

By carefully uncrating the units the 1″ x 4″ crating can be used to form legs for the baffles. Two lengths are used to form each leg, the edge of one against the face of the other at an angle of 90° on the cross section, and securely nailed about every eight or ten inches throughout their length. Four of these, one nailed to each corner of the low frequency baffle, extending below to a predetermined equal length, will give the baffle its correct height. Each nail should be driven on an angle with the alternate nail at an opposite angle, thereby giving maximum bond between two pieces forming the leg and securing it to the baffle.

Cross pieces nailed to the legs as braces may also be used as ladders, and will be found very useful when installing the high frequency units and for future servicing of the equipment.—B. Savage, *RCA.*

The SEASON'S GREETINGS and BEST WISHES

to all members of the I. A. T. S. E. and M. P. M. O. of U. S. and CANADA

from

L. U. 414, WICHITA, KANS.

- No "Film carrying" clause in contract—1916.
- The six-hour alternate matinee and night working period—1923.
- Vacations with basic pay—1945.

Changing Motor Mounts

One of the difficulties in changing motor mounts is the actual holding of the motor while working on it. I find that a wooden block about 8″ square and 2″ thick with a hole, shaft size in the center, does the trick. The motor is upended and the shaft stuck in the hole, thereby making it much easier to complete the job.—C. H. Reyner, *RCA.*

Noise in the No. 1 Type Sound Unit

I recently traced a case of noise to poor electrical contact between the frame and the two machine screws which hold the connecting block assembly P-231410 in the p. e. c. compartment of the Type No. 1 sound head. This was evidently due to slight leakage through the block to the screws which were making poor electrical contact on account of the paint on the case. The paint under the screw heads was removed and the noise disappeared. —M. McMillan, *Altec.*



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OSCILLATOR CIRCUITS

(*Continued from page* 10)

and re-tuning as required may be the simpler solution.

Other Oscillator Types

The mere handful of oscillators described here in outline does not by any means exhaust the list of such circuits. Only two types have been so much as mentioned heretofore. Except for the relaxation oscillators described briefly in connection with sawtooth wave shapes, all of the oscillators referred to herein are of the feedback type.

But there are also oscillators that work on other principles. Among other oscillator types, some of which utilize feedback while others do not, are negative resistance oscillators, beat frequency oscillators, magnetostriction oscillators, to name a few.

A rather popular oscillator is the dynatron oscillator. The circuit strongly resembles the electron-coupled oscillator shown in Figure 5, but with this vital difference: in the electron coupled oscillator the plate voltage is higher than the screen voltage—in the dynatron oscillator the reverse is the case, and the dynatron circuit can be identified by that difference. Secondary emission of electrons from the plate is utilized in the dynatron; the fact that the screen is kept at higher potential than the plate attracts these electrons to the screen. Hence, so far as plate and screen alone are concerned, the plate acts as a cathode supplying electrons to the screen. This reverses the normal internal resistance of the tube, providing so-called "negative resistance." The dynatron is one type of negative resistance oscillator. If a tuned circuit is connected between screen and plate. a.c. will appear in that circuit at the frequency to which it is tuned.

Another means of distinguishing the dynatron diagram from Figure 5 is that the control grid circuit in Figure 5 is tuned; in a dynatron diagram it would not be. Further, there are transitron oscillators, magnetron oscillators, klystron oscillators, Barkhausen-Kurtz oscillators, mechanical-electronic oscillators—and these do not exhaust the list.

In the Barkhausen-Kurtz oscillator a triode is used with the grid strongly

Greetings and Best Wishes

for a very Merry Xmas
and a Joyous New Year

from

LOCAL NO. 253, I. A. T. S. E. ROCHESTER, NEW YORK

Best Wishes for a Very Happy

HOLIDAY SEASON

Local No. 447, I.A.T.S.E.
SPRINGFIELD, MO.

E. B. DeVRY CONTACTS FIRM'S DISTRIBUTORS ON AIR TRIP

Edward B. DeVry, secretary-treasurer of the DeVry Corporation, Chicago, who just completed a flying trip to the Southwest and Mexico, upon his return stated that he feels that Mexico and Central America are outstanding prospects for theatre equipment, films and for audio-visual teaching equipment. The purpose of the trip was to confer with the company's distributors and to visit the sites of two new installations of DeVry 35-mm motion picture sound equipment.

He pointed out that a triumph for American projection and amplifying equipment was accomplished at the Juarez Theatre, Juarez, Mexico, where unusual structural areas and a dome effect presented an acoustical problem. Performance of the DeVry equipment was so satisfactory, he explained, that the theatre operator circularized other Mexican operators praising the new installation.

GOLDRICK TO MANAGE W. E. OF LONDON

M. A. Goldrick, formerly regional manager for Northern Continental Europe, has been named managing director of Western Electric Co., Ltd., London, it was announced by T. K. Stevenson, president of Western Electric Export Corporation. H. L. Marsterson, director and controller, who has been deputizing for the managing director during the past five years, will report to Mr. Goldrick, who has been inactivitated by the Navy in which he held the rank of commander.

positive and the plate negative. Some electrons emitted from the filament have such initial velocity that they are not immediately captured by the positive wires of the grid, but pass through the meshes toward the plate, which repels them again in the direction of the grid. This oscillatory movement of the electron cloud surrounding the grid is the source of the a.c. delivered by the tube; the frequency is determined primarily by the grid voltage.

And still other types of oscillators are said to have been developed during the war, but to be military secrets at present.

More detailed discussions of individual oscillator circuits will appear in I. P. from time to time in connection with analysis of specific apparatus drawings. The above is no more than a brief introduction to a large and complicated subject which is becoming increasingly important to every projectionist.

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PROJ. LIFE OF FILM

(*Continued from page* 15)

the wearing property was not satisfactory. In a repeat test, it was much better, and when applied to both sides of the film, it was better than that of the edge-waxed sample. It is admitted that the application of wax to both sides of film may present other problems—such as difficulty in splicing, *etc.*

Any simple wax application depends for its effectiveness on the principle that the treated surfaces will be more resistant to abrasion than those not similarly treated. Whereas this is true in some cases, as seen in Table I, the fact remains that no practical film surface has been found which will resist abrasion indefinitely. Therefore, when these treated surfaces become abraded, they present the same problem as do any other scratched films.

We may distinguish, then, between the resistance offered to abrasion by a simple lubricant and the protection of the film surfaces from abrasion by a thicker coating, such as a lacquer. In addition, it is necessary not only to have the lacquer coating of such a thickness that it will carry the abrasion which normally is borne by the film surfaces, but, to be really effective, it must be removable and renewable. Thus, at any time in the life of the film, the entire external surfaces of the film can be renewed. Only in this way can "new print" quality be maintained.

Conclusions

It has been shown that an increase in the wear life of film will result if the diameter of the intermittent sprocket is increased from 0.935-in. to 0.943-in. This fact has been demonstrated many times by laboratory tests. The results in the laboratory have been verified by trade tests in which it has been shown that the 0.943-in. intermittent sprocket will give from 2 to 3 times the number of projections, before breakdown of the film, as the 0.935-in. sprocket after each sprocket had been in theatre use for over 1500 hr.

Laboratory tests indicate that a decrease in gate tension would increase the wear life of film severalfold.

The centering of the perforations on the intermittent sprocket has a considerable bearing on the wear life of film.

Mention has been made of the necessity for the reduction of the damage to the edges of prints. Two methods by which this damage can be minimized have been described.

Abrasion of the surface of film can be reduced by the application of wax to the entire surface. Surface abrasion

can be eliminated almost completely by the application of a renewable lacquer.

Acknowledgment

The writer wishes to express his sincere appreciation to Dr. E. K. Carver for his many helpful suggestions and for continued guidance in the preparation of the paper, and to the various members of the film-testing departments of the Eastman Kodak Company for their contributions.

DISCUSSION

MR. HERBERT GRIFFIN: The paper is now open for discussion.

MR. M. S. LESHING: A few years ago the Eastman people advocated a protective lacquer treatment of negative film right after processing. After a period of time the question of the lacquer died. What happened to it?

MR. TALBOT to MR. D. E. HYNDMAN: Don, would you like to answer that question?

MR. HYNDMAN: To my knowledge the Eastman Kodak Company, as a policy, did advocate applying a protective lacquer to either processed positive or negative film, but the use of it was never discouraged.

MR. LESHING: The reason, I think, that the Kodak Company planned using a lacquer is shown by the fact that Mr. Capstaff was, as he told us, providing the developing machine in the Kodak Research Laboratories with a special cabinet for applying the lacquer to the negatives.

MR. HYNDMAN: The only answer I can give would be my personal opinion. The Eastman Kodak Company has sold and delivered lacquer to anyone desiring it. It was and is still used mainly by the Ace Film Laboratories in Brooklyn, New York. It has used lacquer for a period of years. I have inspected, personally, negatives on which lacquer has been applied. After 475 release prints have been struck from the negative, the lacquer was removed. The concensus of opinion was that the negative looked practically as good as before printing. for this reason Ace Film Laboratories, Inc., continued to use the lacquer. We would sell the lacquer to anyone who wishes it, but we have not tried to thrust its use on any concern. It is available.

MR. TALBOT: As a service of the Kodak Company we will provide specific recommendations on equipment to apply the lacquer.

MR. PAUL ALLEN: It seems to me that the industry is missing an opportunity. If it would purchase 30,000 sprockets at about $150,000, it would save about half of the film cost. There are the facts that should be presented.

MR. GRIFFIN: As a representative of the company mentioned. the International Projector Corp., probably one of the largest manufacturers of sprockets in the world, I have been most interested in this subject for many, many years and am heartily in accord with what this paper has shown. As a matter of fact I presented the same type of paper in the past which I read before



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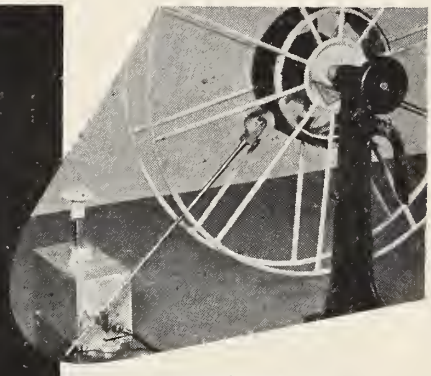


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Greetings

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the Society in 1933 and which was published in the January 1934 issue of our JOURNAL. However, on the basis of that I issued a preemptory order to our Engineering Department to change all intermittent sprockets from 0.935-in. to 0.945-in. diameter which we promptly did and probably shipped several thousands. Shortly thereafter we were called upon to replace sprockets for the reason that there was a noise regardless of what the previous speaker said. A noise would show up from a slight undercut of the pull-down tooth. We replaced all of the 0.945 sprockets.

I agree that in those days the shrinkage problem was more acute than it is today. However, that situation did exist with the result that we were called upon to replace thousands of sprockets. Our company is in business to make money and cannot continue to replace sprockets. The projectionists just would not use them. I agree with the gentleman who said it would be a wise plan on the part of the film manufacturers to supply the sprockets themselves, but I don't think that would work either, as they would have the same problem and the same results. Anybody like to rebut that?

MR. TALBOT: May I ask you one question? Are you sure that those sprockets used at that time were hardened steel or were they soft steel?

MR. GRIFFIN: They were hardened and ground steel. The radii were ground also on all of the teeth and still are.

MR. TALBOT: The only thing that I can say, more or less in rebuttal, would be that if these sprockets have been in use for approximately one year and still give double the life of film, it would pay the exchanges to replace the sprockets today if they had to. I mean, if after a year they are still getting better runs, even if it were true at the end of a year the sprockets began to wear and had to be replaced, it would still seem worth while for the exchanges to do this rather than have to buy so much film.

MR. GRIFFIN: With that I heartily agree. Nevertheless we had to shoulder the burden and would not want to have to do it again. I still want to recommend a 0.943-in. sprocket.

MR. E. J. DENISON: Regarding edge damage to film, mentioned in Mr. Talbot's paper, it has been my experience over a period of years covering film exchanges that a great deal of the edge damage is actually done during rewinding of the film in the exchanges and not by projectionists or projection machines. If one will visit the average film exchange today he will find that rewinds are badly out of alignment, with the result that the film traveling from the free-running reel to the rewinding reel is drawn across the side of the rewinding reel, resulting in the film being broken through from the outer edge to the perforations. Further, the out-of-line setup of the rewinds results in some convolutions of the film protruding from the side of the roll. When one reel is stacked on top of another during handling by the film shipper or truck driver, these convolutions which protrude from the roll are broken down by weight, resulting,

of course, in considerable edge damage to the film.

The matter of edge damage to film has been discussed before the National Film Carriers Association for several years past, with demonstrations as to the cause of this particular type of damage, as well as the SMPE, without result. The National Film Carriers Association has taken serious steps in the past to prevent undue rough handling by their drivers, but to my knowledge they have had little success.

From time to time the idea has been advanced that some of this edge damage is due to poor quality of film which, of course, is not true. A number of years ago I made a slow-motion picture for Paramount showing damage to film due to improper splicing. This picture demonstrated the necessity of proper splicing in order to prevent damage to the film at the point of splicing. Today several of the distributors have their exchanges equipped with a modern and efficient splicing device, with the result that these distributors have very little film damaged due to splicing.

Before making the picture demonstrating results of bad splicing, I gathered film scraps from some 35 exchanges throughout the United States, and analyzed and catalogued each particular type of damage due to improper splicing. The result of this analysis was the slow-motion film mentioned.

The point I am trying to make is this: I believe that in order to overcome excessive edge damage to film, or any other type of damage, it is necessary to visit a sufficient number of exchanges throughout the country, gather samples of film damage, analyze and catalogue them. Any particular type of damage to film can quickly be catalogued by an expert and only then can proper steps be taken to correct this evil.

In my opinion, testing or analyzing film damage cannot be satisfactorily arrived at in a laboratory. The life of motion picture film has been greatly increased in the past years due to intelligent investigation and analysis of causes. There is still considerable research to be done to bring about the maximum life of positive prints and most of these causes will be found in the field, mainly in the film exchanges.

With the advent of sound it was necessary to keep projector heads in a much better mechanical condition than in the silent days. There have been many attempts to correct sprocket pitch, take-up tension, use of bad reels, *etc.*, all of which are contributing factors to various types of film damage.

Positive film is handled only in exchanges and theatres, consequently it is my belief that a thorough survey of these 2 branches of the industry should result in the establishment of the necessary standards for the proper handling of film.

First, the investigation should be made in the exchanges where, it will be found, a great deal of the damage to film occurs. There should be designed a good rewind and a blueprint for the installation of these rewinds. Also it is considered practical to install between the rewinds a guide for

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keeping the convolutions of the roll of film smooth in its travel from the free-running reel to the rewinding reel. Good reels should always be used in connection with the inspection and rewinding of film in exchanges. All devices used in the exchange in connection with inspection and handling of film should be engineered into the general setup.

In the past there has been a number of treatments for positive film tested. Some were found beneficial, others showed no improvement in the life of the film. Today it is definitely known that there are certain treatments for positive film that actually retards scratching, keeps the film pliable, retards oil absorption, and, in general, while not necessarily prolonged the life of the film by such a treatment, will keep the film in a new condition for a longer period of time.

It is this speaker's thought that it would not be amiss to appoint a committee of experts to make a thorough survey on the care and handling of film.

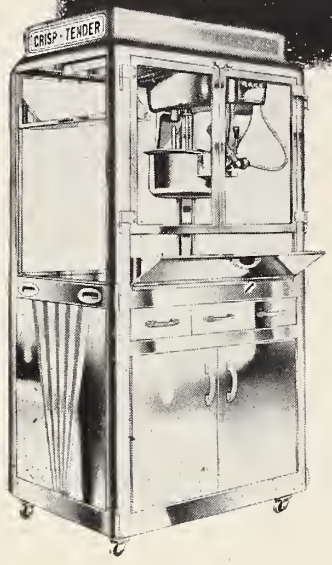
MR. GRIFFIN: I hope the Editorial Board will find it possible to promptly publish this paper. It will be most interesting to all projection manufacturers including my own company. Thank you, Mr. Talbot.

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Mr. Handley will serve the Western portion of the country and Mr. Ries the East. Mr. Kunzmann will continue his nation-wide general activities as well as aid in this specific work in the central portion of the country.

The technical service group, in general, will supplement the work of the lighting carbon salesmen of the National Carbon Company in matters of a technical nature pertaining to all lighting carbon applications. Among its functions will be discussions with projectionists and distributors on the scientific aspects, best utilization and unusual applications of the carbon arc for projection in all kinds of existing and new equipment.

The group also will work with motion picture studio technicians on studio lighting problems and with the photo-engraving, lithographic and blueprint trades. Assistance will be rendered with company's research and development activities in cooperating with manufacturers of carbon arc equipment.

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H. M. Bessey, vice president of Altec Service Corporation, announces that Walter W. Simons has been named advertising and publicity manager of the organization. In this capacity Mr. Simons also will handle trade paper advertising and publilcity for Altec Lansing Corporation. With Altec since its formation he was assigned in 1942 to the electronic division at Lexington, Mass., where he remained until the completion of the project early this Spring. At that time he returned to New York and has been associated with the commercial engineering group until now.

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MAYNARD K. BAIRD, first saw the light of day in Memphis, Tenn., forty-eight years ago. He is regional director for the Labor League for Human Rights, A. F. of L.'s public relations program, and is a charter member of I. A. Projectionists' Local No. 405, Knoxville, Tenn. He has held practically every office in the local, and was business agent until he started working with the Labor League.

For seven consecutive years Baird held the office of president of the Knoxville Central Labor Union, retiring from that post when he accepted his present position with the Labor League. He has held a volunteer organizer's certificate from the A. F. of L. for the past twenty years.

Maynard Baird's union activities are further augmented by his membership for the past 25 years in the Musician's Union, Local No. 546, A. F. of L. He spent a number of years traveling about the country with his own band, which was booked by the Music Corporation of America. He has made eight recordings for the Vocallion Company of Chicago, two of which were outstanding hits—"Postage Stamp" and "Just For You."

Baird has been active in the Tennessee State labor movement for some twenty years. In 1936 he was chairman of the Labor Day Committee which brought President William Green to Knoxville to deliver the Labor Day address.

For the past three years he has been very active in promoting CLU and A. F. of L. members' participation in war activities and community affairs, and in stimulating interest in forming common grounds between labor and the community.

While his headquarters are in Knoxville, his territory covers Tennessee, Alabama and Mississippi. Baird covers his territory by car, which is equipped with a complete 16-mm sound motion picture outfit, a speed Graphic camera, piano accordion and other musical instruments as well as 16-mm war newsreels, from the bombing of Pearl Harbor to the present time. All this equipment is used to promote good will between labor and the community.

Maynard Baird is married and has five children. One of them, Maynard, Jr., served with the Marines at Okinawa. He also is a projectionist, a member of Local No. 405, and of Musicians' Local No. 546, indicating that he is moving along in his pappy's footsteps.

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IN THE SPOTLIGHT

(Continued from page 19)

of both Democratic and Republican parties can learn a trick or two from these seasoned 306 campaigners. Politics do make strange bedfellows!

For the office of president, the incumbent, Herman Gelber, is being opposed by Harry Mackler, former president of the local. Our prediction is after December 26 one of these men will be an ex-president of Local 306.

● They are at it again—these labor-baiting employers. At the recent Chicago convention of the American Veterans of World War II (AMVETS), the Texas delegates tried to put over a resolution denouncing the closed shop and recommending legislation which would exempt veterans from union affiliations even in plants where closed shop agreements prevail. Had they been successful, it would have paved the way for the anti-labor employers to use ex-service men as pawns in their attempts to break the union shop. Delegates from other states immediately saw the danger of such a proposal and rejected it.

According to "Labor," a national weekly union publication, Edwin Bruder of Chicago, a national executive committeeman of AMVETS, attacked the resolution as a "direct threat to the union shop, which we don't want to see broken up by unscrupulous employers."

It was further pointed out that although the Texas group threatened to resign from AMVETS, they are in pretty much of a pickle in their home state. Veterans in the State of Texas are up in arms over the recent exposure of the fact that Karl Hoblitzelle, president of the Interstate Circuit of Texas and one of the country's leading movie magnates, had been secretly contributing $400 a month in support of a Texas AMVETS paper which had been used for propaganda purposes against organized labor.

Mr. Hoblitzelle employs I. A. men in his theatres and although he is a bitter opponent of the two-man shift in theatre projection rooms, we always believed him to be kindly disposed towards labor. It looks now as though we might have been mistaken in our assumption—perhaps Mr. Hoblitzelle's recent appointment as director of a bank has colored his views on labor.

● When last heard from, about two months ago, Gordon Keeler of Local No. 597, Waco, Texas, and son of secretary Charlie Keeler, was in Manila Bay, heading for Nagoya, Japan, for occupational duty.

● Business agent Bill Thompson, of Local No. 171, recently concluded negotiations with theatre circuits in his city which resulted in new three-year contracts calling for an immediate increase of 10c per hour; an additional 5c per hour increase at the beginning of the second year; double time for midnight shows (minimum three hours); and vacations with pay. All increases are retroactive to September 1, 1945.

ALTEC APPOINTMENTS

Lt. Col. Nathaniel L. Mower has been appointed branch manager of the Atlanta district, Altec Service Corporation recently announced. Col. Mower formerly was district service supervisor in Atlanta for ERPI.

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(Continued from page 17)

coverage radius of 50 miles is possible. whereas at an altitude of 30,000 feet a coverage radius of 211 miles is possible. and at 50,000 feet about 300 miles is possible.

Another very interesting feature of high-altitude operation is the fact that as the station's height is increased, the transmitted power necessary to deliver a usable signal to the line-of-sight distance is sharply reduced.

Fifty kilowatts of power will deliver a usable signal at approximately 50 miles from a ground station, whereas only one kilowatt of power will deliver the same usable signal at approximately 200 miles from 30,000 feet. Smaller powers are required from the higher altitudes because the path difference between the direct wave and the ground-reflected wave is increased.

The fact that such small powers are required from high altitudes is very inviting for several reasons:

1. The broadcast service area covered is relatively tremendous.

2. The smaller-powered transmitters can be made in sizes and weights which are practical from the standpoint of carrying them in an airplane.

3. Powers of the order of one kilowatt can be generated with tubes which are available today—even for the CBS high-definition color television frequencies.

4. The small amount of power required to operate the transmitter can be obtained from power plants installed in the airplane. If so desired, the power required to operate the equipment could be taken from generators connected to the aircraft's engines. This power will represent only about four per cent additional load on the plane's engines.

If we transmit from one plane to the next plane in the chain, the line-of-sight distance between the two planes is about 400 miles instead of the 35-mile spacing for ground stations. With such large relay spacings a program link from Hollywood to New York is obtainable with only eight airplanes as compared with 100 relay points on the ground.

This greatly reduces the technical problems involved by virtue of requiring fewer handlings of the program. With directional antennas and utilizing relay frequencies on the order of 2,000 megacycles, this relaying can be done between airplanes with powers of less than one watt. Tubes readily are available which will generate powers of 5 watts in this frequency range.

These relay stations could be designed to carry several television programs and also an abundance of other information such as FM network programs, facsimile, motion picture theatre television, etc.

Because the broadcasting service area and relay spacings increase with altitude and the power required to service the broadcasting area comes down as altitude is increased, it is desirable from a standpoint of radio operation alone to operate the plane at as high an altitude as possible.

The altitude of operation of the system is limited by the economic and technical problems involved in operating planes at extreme altitudes. A study of the overall combination of radio and airplane operation indicates that an operating altitude between 30,000 feet and 50,000 feet provides a good compromise.

(TO BE CONTINUED)

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Technically smart and super-efficient ladies of the industry's technical branch recently threw a luncheon party for Dora Goldman, secretary extraordinary for many years to high officials of International Projector Corp. Pictured above (l-r) are: Florence O'Neill, National Theatre Supply; Ruth Entracht, International Projectionist; Betty Connolly, Warner Bros.; Toby Roth, Prudential Circuit; Elizabeth White, RKO; Frances Tannenbaum, RKO; Evelyn Gang, I.A. Local 306; Miss Goldman; Lee Schindler, Century Circuit; Clara Schmitt, N.T.S. Co.; Lillian Perlman, Paramount; Lillian Morgan, Loew's, Inc.; Veronica Stock, Loew's Inc., and Margaret Marayno, Local 306. (P.S.: They found time to eat, too.)

JAN 26 1948

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